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ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 5/2
GUIDE FOR PREPARATION OF WATERWAYS EXPERIMENT STATION TECHNICAL--ETC(U)
MAR 79 T B ROSSER, R T SMART, R M SCHAFF

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WES-INSTRUCTION-0-79-1

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PREFACE

This Guide describes procedures to be used by U. S. Army Engineer Waterways Experiment Station (WES) personnel in the preparation of reports for publication and distribution. Such procedures should simplify the author's task by furnishing him a guide to follow in arranging his material and should reduce the costs of report preparation and production.

The Guide establishes procedures for insuring uniformity of certain features common to all reports, while permitting flexibility in the presentation of the technical subject. Matters requiring uniform treatment are clearly indicated throughout the Guide. Suggestions for good practice in the presentation of data and text material are included to assist the author in producing a clear, concise, and well-organized report. This Guide supersedes WES Instruction Report O-74-1, dated April 1974, which superseded WES Instruction Report 9, dated September 1967. The idea for the 1967 Instruction Report was originated by Miss Katharine H. Jones, former Chief, Reproduction and Reports Office, and the report was compiled by Mr. Richard T. Smart, Chief, Reports Branch. The significant changes herein are changes in report designations, style and format of bibliographic information, and location in report of the trade names notice. Also, the word list has been expanded to include additional words frequently used in WES reports.

The following references were of great assistance in preparation of the Guide:

Defense Atomic Support Agency (now Defense Nuclear Agency). 1966. "Weapon Test Reports Preparation Manual," DASA-26, Washington, D. C.

Defense Nuclear Agency. 1973. "Standards for DNA Scientific and Technical Reports," Washington, D. C.

U. S. Army Missile Command, Research and Development Directorate. 1966. "The Preparation of Scientific and Technical Documents," 3d ed., Redstone Arsenal, Ala.

Ulman, J. N., Jr., and Gould, J. R. 1965. *Technical Reporting Revised*, Holt, Rinehart and Winston, Inc., New York.

Technical Editing, Weil, B. H., ed. 1958. Reinhold, New York.

Katzoff, S. 1964. "Clarity in Technical Reporting," 2d ed., NASA SP-7010, Scientific and Technical Information Division, National Aeronautics and Space Administration, Washington, D. C.

Rathbone, R. R. 1961. "Writing and Editing Reports," Publications in the Humanities No. 49, Department of Humanities, Massachusetts Institute of Technology, Cambridge, Mass.

A Style Manual for Technical Writers and Editors. 1962. Reisman, S. J., ed., Macmillan, New York.

Permission to quote the copyrighted material from Ulman and Gould that is included herein was obtained from Holt, Rinehart and Winston, Inc. Permission to use the copyrighted material from Reisman was obtained from The Macmillan Company.

This Guide was compiled by Mr. Thomas B. Rosser, Chief of Publications and Graphic Arts Division, Mr. Richard T. Smart, Chief, Reports Branch, and Mrs. Rosemary M. Schaff, Chief, Editorial Section. The painstaking efforts of all Reports

Branch personnel who participated in some way in the preparation of the Guide are gratefully acknowledged.

Director and Technical Director of WES during the initial preparation of this Guide in 1967 were COL J. R. Oswalt, Jr., CE, and Mr. J. B. Tiffany, respectively. Director and Technical Director of WES during the updating of this Guide in 1974 and 1975 were COL G. H. Hilt, CE, and Mr. F. R. Brown, respectively. The Commander and Director and Technical Director of WES during the 1979 updating of this Guide were COL J. L. Cannon, CE, and Mr. F. R. Brown, respectively.

The requirements of the Guide are implemented by Station Regulation SR 70-1-3; its provisions are *mandatory* for WES in-house or contractor-prepared technical-information reports.

CONTENTS

	Page
PREFACE	1
PART I: INTRODUCTION	5
Why WES Reports Are Written	5
Factors Influencing Content and Format of WES Reports	5
Philosophy of Reports	6
What the Guide Contains	6
PART II: DESIGNATION, ORGANIZATION, AND CONTENT OF WES REPORTS	7
Designation and Cover Color of WES Reports	7
Components of Reports	8
Cover	8
Report Documentation Page, DD Form 1473	14
Preliminaries	14
Main Text or Body of Report	19
References to Source Material	21
Tables and Illustrations	22
Appendixes	23
Notation	23
Index	24
Distribution List	24
Catalog Card	26
PART III: FORMAT AND STYLE	27
Format for Preliminaries and Main Text	27
Format for Appendixes	33
Style	34
PART IV: PREPARATION, PROCESSING, AND DISTRIBUTION OF WES REPORTS	37
Preliminary Planning	37
Preliminary Draft	37
Final Draft	43
Exceptions to Process Described Thus Far	44
Distribution of WES Technical Publications	46
PART V: THE WRITING/EDITING FUNCTIONS	47
The Writing Function	47
The Editing Function	50
PART VI: ERRORS OFTEN FOUND IN WES REPORT MANUSCRIPTS	54
Voice	54
Use of Strong Verbs	54
Nomenclature Consistency	54
Precision in Use of Terms	55
Use of Relative Pronouns	55
Collective Nouns	55
Person	55

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Tense	56
Dangling Modifiers	56
Restrictive and Nonrestrictive Phrases and Clauses	56
Correct Use of Notations Involving Powers of Ten	57
Use of Text to Amplify, Discuss, and Explain Tables and Graphs	58
REFERENCES	60
BIBLIOGRAPHY	61
APPENDIX A: WORD LIST	A1
APPENDIX B: ABBREVIATIONS GUIDE FOR WES REPORTS	B1
APPENDIX C: GREEK ALPHABET, AND MATHEMATICAL SYMBOLS AND EXPRESSIONS	C1
Greek Alphabet	C1
Mathematical Symbols and Expressions	C1
APPENDIX D: COPY PREPARATION	D1
Part I: Introduction	D1
Part II: The Format	D2
Part III: Titles and Headings	D5
Part IV: Tables	D14
APPENDIX E: USE OF COPYRIGHTED MATERIAL	E1
APPENDIX F: MULTICOLOR PRINTING	F1
APPENDIX G: INDEX	G1

GUIDE FOR PREPARATION OF WATERWAYS EXPERIMENT STATION TECHNICAL-INFORMATION REPORTS

PART I: INTRODUCTION

WHY WES REPORTS ARE WRITTEN

1. Reports of Waterways Experiment Station (WES) research generally constitute the end product of technical investigations and provide a formalized record of data and results. Therefore, it is important that such reports describe the investigation and the information obtained from it in a lucid and well-organized manner, and in language easily understood by the intended audience. The report should clearly communicate what was done and what was learned in relation to the purpose for which the investigation was initiated. Reports that are well written, organized, and reproduced can establish a highly favorable impression on the intended audience. Therefore, the mechanics of writing, preparing, and publishing reports can be most important to an agency's professional reputation.

2. Some reports are prepared for general information purposes rather than to satisfy a particular requirement. Such reports usually are used to disseminate information of interest to other laboratories or offices, and sometimes to scientific and educational institutions, private engineers, or engineering concerns.

3. Other reports are written primarily to provide a permanent record of data and results for the investigating office and thus receive only limited distribution. Though not given wide circulation, they should be complete and descriptive if they are to be of any future use.

FACTORS INFLUENCING CONTENT AND FORMAT OF WES REPORTS

4. The content of a report and the manner of presenting data are generally influenced by sponsor requirements and the extent of the report's ultimate distribution. In general, a report that will receive broad distribution should be more comprehensive in detail than one of limited distribution in order to permit the uninitiated reader to gain an understanding of the problem studied and the results of the investigation. However, such reports should not be burdened with a mass of detailed data. In contrast, a report prepared for record purposes only, or for limited distribution, need not be as carefully edited, and the tables and illustrations need not be as mechanically perfect as those of a report prepared for wide distribution. In order to allow WES authors to obtain a limited quantity (up to 30 copies) of a report at minimal expense to their sponsor, or for record purposes, a rough report (one in which little or no editing or final drafting has been performed) may be published as a formal

WES report at the discretion of the Laboratory Chief involved. However, copies must be of good graphic quality to permit reproduction of legible copies on a mass production basis by the Defense Documentation Center (DDC) (see paragraph 46 below).

PHILOSOPHY OF REPORTS

5. In writing a technical report, the author should keep in mind two principal requirements:

- a. The report must contain all essential information needed by agencies that will use it, but should not include nonessential information that might burden or confuse the reader.
- b. The form and language of the report should be such that the information it contains can be efficiently absorbed at the executive, planning, using, and reference worker levels.

Compliance with the first requirement should minimize the size of a report. Reports are frequently too voluminous, the trend being to include everything of data category. Which data to include or what to omit varies with the report; these decisions are generally made by the author. However, only a *minimum* of data need be presented as long as the remainder is available for use by anyone interested (either in the form of appendixes to the report or in the files at WES) and a statement to that effect is included in the report. Appendixes are discussed in Part II.

WHAT THE GUIDE CONTAINS

6. This Guide lists certain items that must be included in all reports, gives the locations of these and other major elements, and outlines the types of information to be included in some of these elements. The Guide also prescribes ways of handling certain questions concerning format and style that confront most authors. Grammar is discussed only briefly; instead, reference is made to commonly used textbooks for this type of information. A list showing the preferred spelling of difficult or uncommon words used in WES reports is included as Appendix A. A list of abbreviations commonly used at WES is included as Appendix B. Mathematical symbols and expressions are discussed in Appendix C. Format and physical characteristics of WES reports are described in detail in Appendix D. Appendixes E and F give guidance for the use of copyrighted material and multicolor illustrations, respectively. For the convenience of the user of this Guide, an index is included as Appendix G.

PART II: DESIGNATION, ORGANIZATION, AND CONTENT OF WES REPORTS

DESIGNATION AND COVER COLOR OF WES REPORTS

7. The principal categories of WES reports are:

- a. *Technical Reports.* Reports of major engineering and/or scientific investigations.
- b. *Miscellaneous Papers.* Reports of minor (not major) investigations of limited scope and/or interest; reports prepared for publication by other agencies; papers prepared for professional journals; interoffice and intraoffice memoranda of sufficient importance to warrant making of record; or memoranda concerning technical investigations written for record purposes only.
- c. *Instruction Reports.* Reports in which new or revised techniques and/or procedures are outlined or proposed for accomplishing a particular engineering feat.
- d. *Translations.* Reports translated from foreign literature thought to be of value to WES or other Corps of Engineers offices.

WES also publishes several special categories of reports or publications such as the Handbook for Concrete and Cement, Hydraulic Design Criteria, General Investigation of Tidal Inlets (GITI) reports, Committee on Tidal Hydraulics bulletins, Committee on Channel Stabilization reports, Mississippi Basin Model reports, Pavements and Soil Trafficability Information Analysis Center (PSTIAC) reports, and Earth Dam Criteria reports. However, creation of a special series of reports requires *advance* Executive Office approval. The normal criterion for creation of a new series is a *major* research program in which a large number of reports will be produced. The reports in categories *a* through *c* above will be identified by a report number assigned by the Publications and Graphic Arts Division (P&GAD) that will consist of (a) a letter(s) identifying the WES laboratory or program responsible for the report; (b) the last two digits of the calendar year in which the report is being published; and (c) a number which will be the next number in that series of reports for that particular laboratory or program. The last-mentioned number will start over with 1 on 1 January each year. The prefix letters identifying WES reports will be:

- A Aquatic Plant Control Research Program
- D Dredged Material Research Program
- E Environmental and Water Quality Operational Studies
- EL Environmental Laboratory
- GL Geotechnical Laboratory
- HL Hydraulics Laboratory
- R Recreation Research Program
- SL Structures Laboratory
- O All others

For example, Technical Report HL-79-1 will be the number of the first publication in the Technical Report series issued in 1979 by the Hydraulics Laboratory.

8. The covers of each principal category of WES reports have a distinctive color: Technical Reports and Translations, blue; Miscellaneous Papers, tan; Instruction Reports, brown. Exceptions to this are: Dredged Material Research Program reports, dark gold; Aquatic Plant Control Research Program reports, avocado; Environmental and Water Quality Operational Studies reports, dark green; Recreation Research Program reports, light green; and ESSEX reports, white.

COMPONENTS OF REPORTS

9. The principal components of a WES report (though some reports may not contain all of them, as discussed in subsequent paragraphs) are:

- a. The cover.
- b. DD Form 1473.
- c. Preliminaries.
- d. Main text or body of the report.
- e. References and/or bibliography.
- f. Tables and illustrations, i.e., Figures,* Photos, and Plates.
- g. Appendixes.
- h. Notation.
- i. Index.
- j. Distribution list (if required by sponsor).
- k. Facsimile of library catalog card.

These components, discussed in subsequent paragraphs, are prescribed in Army Regulation 70-31 (Headquarters, Dept. of the Army, 1966), "Standards for Technical Reporting," and Military Standard MIL-STD-847A (Dept. of Defense, 1973), "Format Requirements for Scientific and Technical Reports Prepared by or for the Department of Defense." They must be included (if applicable) in all WES Technical Reports, Miscellaneous Papers, and Instruction Reports, except those sponsored by the Defense Nuclear Agency (1977) or any other agency that requires that its own specified format be followed.

COVER

10. The cover of every WES report will include the following:

- a. Castle symbol** of the Corps of Engineers and the WES symbol.
- b. Report designation and number.
- c. Title of report.
- d. First name, middle initial, and surname of author(s).
- e. Name and address of performing organization (i.e. WES, except in the case of contractor-prepared reports).

* Arranged in this order.

** Corps of Engineers logotype as approved by the Chief of Engineers will be used.

- f. Publication date (month and year when report is sent to the Printing Plant for reproduction).
- g. Type of report (i.e. interim, final, etc.) and, if applicable, dates covered.
- h. Distribution statement (see paragraph 11).
- i. Name and address of sponsoring agency.
- j. When appropriate, contract, project, subtask, and work unit numbers.
- k. When appropriate, name and address of monitoring agency.

Classified report covers will also show the report and title classification and the declassification/downgrading schedule. Figures 1-3 are examples of covers for unclassified reports, classified reports, and contractor-prepared reports, respectively.

11. One of the primary distribution statements (A or B) shown in Figure 4 will be included on the front cover of all reports, as required by AR 70-31 and Department of Defense Directive 5200.20 (Dept. of Defense, 1970). Distribution Statement B shall remain in effect until changed by the controlling DoD office.

12. The inside of the front cover of all reports will contain "disposition instructions" and a "disclaimer" worded as follows:

a. *Disposition instructions.*

On unclassified reports:

Destroy this report when no longer needed. Do not return it to the originator.

or

When this report is no longer needed, return it to the originator.

On classified reports:

When this report is no longer needed, Department of the Army organizations will destroy it in accordance with procedures given in AR 380-5. Department of the Army contractors will destroy the report according to the requirements of Section 14 of the Industrial Security Manual for Safeguarding Classified Information. All others will return the report to the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 39180

b. *Disclaimer.* On all reports:

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

13. WES reports will not contain material that may be construed as advertising or that implies that the Government endorses or favors a proprietary product or service manufactured or provided by a specific supplier. If it is essential that trade names or names of manufacturers of materials or equipment be given (under the assumption that certain parts of the report are meaningless without them, or that a description included to avoid use of the trade name would be excessively long and involved), such reports will contain a notice on the inside front cover which reads:

THE CONTENTS OF THIS REPORT ARE NOT TO BE USED FOR ADVERTISING, PUBLICATION, OR PROMOTIONAL PURPOSES. CITATION OF TRADE NAMES DOES NOT CONSTITUTE AN OFFICIAL ENDORSEMENT OR APPROVAL OF THE USE OF SUCH COMMERCIAL PRODUCTS.



TECHNICAL REPORT HL-79-1

FILLING AND EMPTYING SYSTEM FOR BAY SPRINGS LOCK, TENNESSEE-TOMBIGBEE WATERWAY, MISSISSIPPI

Hydraulic Model Investigation

by

Jackson H. Ables, Jr.

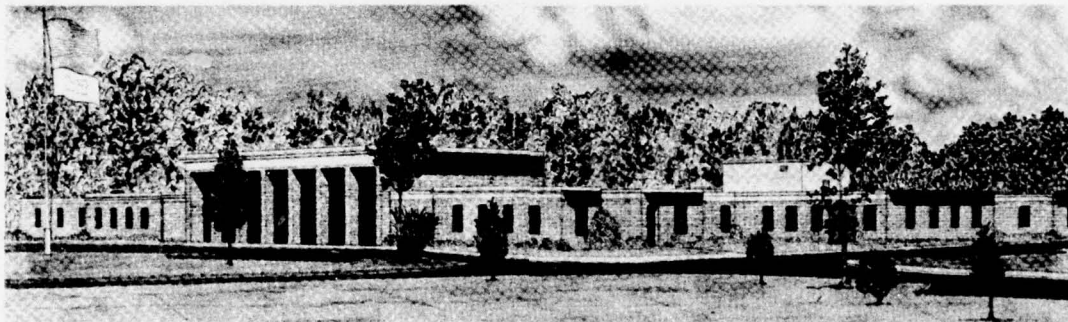
Hydraulics Laboratory

U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

January 1979

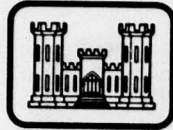
Final Report

Approved For Public Release, Distribution Unlimited



Prepared for U. S. Army Engineer District, Nashville
Nashville, Tennessee 37202

Figure 1. Example of cover of unclassified report



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TECHNICAL REPORT GL-79-1



**FOUNDATION AND MATERIALS REPORT
GROUND MOTION AND SOIL-STRUCTURE
INTERACTION FOR WARREN SAFEGUARD
BALLISTIC MISSILE DEFENSE SYSTEM
MSR SITE NEAR CHUGWATER, WYOMING (U)**

by

Hugh M. Taylor, Jr., Stafford S. Cooper
Geotechnical Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

January 1979

Final Report

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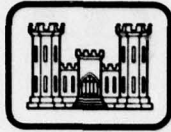
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Figure 2. Example of cover of classified report

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lustrative purposes only.



TECHNICAL REPORT GL-79-2

HYDRAULIC FRACTURING IN ZONED EARTH AND ROCKFILL DAMS

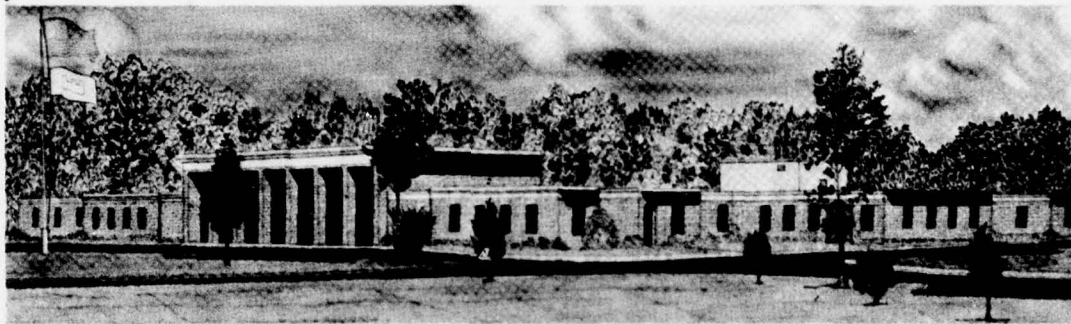
by

Edward S. Nobari, Kenneth L. Lee, J. Michael Duncan
College of Engineering, Office of Research Services
University of California, Berkeley, California 94720

January 1979

Final Report

Approved For Public Release: Distribution Unlimited



Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

Under Contract No. DACW39-68-C-0078

Monitored by Geotechnical Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

Figure 3. Example of cover of contractor-prepared report

Statement	Reason for Use	Discussion
<u>A</u>		
Approved for public release; distribution unlimited.		Indicates document has been cleared for public release by competent authority. It may be made available or sold to the general public and foreign nationals. Never to be used on classified documents.
<u>B</u>		
Distribution limited to U. S. Government agencies only; (fill in reason); (date statement applied). Other requests for this document must be referred to (insert controlling DoD office).		May be used on classified documents if necessary to insure distribution limitation in addition to need-to-know requirements or in the event the document is declassified.
	Foreign information	Information furnished by a foreign government with the understanding that it will not be transmitted outside the U. S. Government.
	Proprietary information	To protect information not owned by the U. S. Government and not protected by a contractor's "limited rights" statement but received with the understanding that it would not be transmitted outside the U. S. Government.
	Test and evaluation	Covers the test and evaluation of commercial products or military hardware.
	Contractor performance evaluation	Management reviews, records of contract performance evaluation, or other advisory documents evaluating programs of contractors.

Figure 4. Distribution statements

14. Other types of information that may be presented on the inside of the front cover (if there is sufficient space) and on the inside of the back cover include lists of associated reports or lists of committee members.

15. Engineer Regulation 18-1-6 (Dept. of the Army 1971) states that release of computer programs and their documentation should generally be confined to Government agencies. Intent of this regulation is twofold: (1) to keep from giving any individual company outside the Corps of Engineers an advantage over anyone else; and (2) to insure that a program developed by the Army will not be sold back to another agency of the Army. Therefore, the inside of the front cover of all WES reports that contain computer program documentation will carry the following notice:

This program is furnished by the Government and is accepted and used by the recipient with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data contained in this program or furnished in connection therewith, and the United States shall be under no liability whatsoever to any person by reason of any use made thereof. The program belongs to the Government. Therefore, the recipient further agrees not to assert any proprietary rights therein or to represent this program to anyone as other than a Government program.

REPORT DOCUMENTATION PAGE, DD FORM 1473

16. A completed DD Form 1473, Report Documentation Page, will be included as the first right-hand page after the cover in each WES report. This page replaces the title page formerly used and revises the DD Form 1473 formerly required at the end of each report. The form is filled out by P&GAD in accordance with the appendix to MIL-STD-847A with information furnished by the author. Normally, it is completed when the final draft of a report is prepared, and is submitted for approval with the final draft. An example of the form is shown in Figure 5. The "key words" to be included in Block 19 are for cataloging purposes. They may be technically meaningful terms or short phrases that identify the principal subjects covered in the report, or they may be equipment model designations, trade names, military project code names, or geographic locations. The author may supply key words if he wishes; however, P&GAD refers each report to the WES Technical Information Center (TIC) for this purpose and to insure that no pertinent terms are overlooked. The author will prepare an abstract for completing Block 20. The abstract should be an informative synopsis of the report.

PRELIMINARIES

Order

17. The preliminary pages or sections usually included in WES reports will be arranged in the following order. Those that are optional and those that are mandatory are so indicated.

- a. Summary (optional, see paragraph 18).
- b. Preface (mandatory).
- c. Table of contents (mandatory).
- d. List of tables.
- e. List of illustrations.

Note: Items *d* and *e* are necessary only when numerous tables and/or illustrations (termed "Figures") are integrated in text; otherwise only total number of Tables, Photos, and Plates need be shown in contents.

- f. Table of factors for converting U. S. customary units of measurement to metric (SI) units (mandatory in most cases; see paragraph 21).
- g. Key (sometimes mandatory, sometimes optional, as explained in paragraphs 22 and 23).

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9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineer Waterways Experiment Station Geotechnical Laboratory P. O. Box 631, Vicksburg, Miss. 39180		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Project 4A762719AT40 Task A2, Work Unit 011,Q6
11. CONTROLLING OFFICE NAME AND ADDRESS Office, Chief of Engineers, U. S. Army Washington, D. C. 20314, and U. S. Department of Agriculture Forest Service Washington, D. C. 20250		12. REPORT DATE July 1978
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Pavement design Pavement deterioration Pavements Reliability		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study utilizes the results of full-scale field and prototype laboratory testing to develop methodology for the prediction of deterioration and assessment of the reliability of pavements. Deterministic equations are developed to predict deterioration in terms of rutting. The extensive data utilized were accumulated over four decades of research and represent a wide variety of pavement types and wheel loads. On-going field data collection programs are supplying additional data (Continued)		

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Figure 5. Example of Documentation Page, DD Form 1473 (front) (Sheet 1 of 2)

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20. ABSTRACT (Continued)

that will provide for deterioration analysis in terms of other modes, using analysis methods shown to be satisfactory in this investigation.

Reliability assessment models are developed using the deterministic deterioration equations as a basis. These models provide for a method of determining the probability that a pavement will give support and desired service for a period of time or number of vehicle operations.

The deterioration analysis and reliability assessment procedures are useful for maintenance and repair prediction as well as prediction of future serviceability.

The combined procedure provides a framework for life-cycle management of pavements. This ability to predict deterioration and assess pavement reliability will represent the first such major addition to current procedures now in use that provide for initial design only.

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Figure 5. Form 1473 (back) (Sheet 2 of 2)

Content

18. *Summary.* A Summary may be included if it is desired to give more information on the content of the report than can be presented in the abstract entered on the Form 1473. The Summary is prepared primarily for the benefit of busy executives or for reference workers. It should be an informative synopsis of the main body of the report, not merely a statement of the results and conclusions, nor a listing of what the report contains. It should describe in a brief, coherent form why the work was done (the problem); the specific purpose or objective of the study; the scope of the work if pertinent; what was done (test methods or investigational means used); and what was learned (results and conclusions). Recommendations may also be included if important enough or if the author wishes to bring them to the attention of sponsoring officials who may read only the Summary. The Summary must be self-sufficient in order to serve its purpose. It necessarily repeats information from the body of the report, and should never contain information not given in the body of the report. It should normally be no longer than one or two pages.

19. *Preface.* The Preface should be used to eliminate administrative matters from the main text. Grouped in this section are all matters that must appear in the report but which are irrelevant to and would detract from the technical text. It will include such information as authorization, pertinent dates, names of WES and other personnel who actually participated in or made a technical contribution to the investigation or report, the author(s), WES supervisory personnel, and any items required for record or acknowledgment purposes. If copyrighted material has been quoted or reproduced, the Preface will include a statement that permission to use the material has been obtained.

20. *Table of contents and lists of tables and illustrations.* The table of contents will contain the exact titles and page numbers of all the preliminary sections, and all Part (or Chapter) titles and primary headings in the main report and in the appendixes (the Contents herein is an example). If the report is so short that it is not broken down into Parts, the table of contents will contain the exact titles and page numbers of the center headings and side headings. If lists of tables and/or illustrations are used, they will be arranged in numerical order and the primary titles and page numbers of the tables and figures will be given. (If a figure has a long descriptive title, only the first sentence will be given.) Figure 6 is an example of such lists.

21. *Conversion factors table.* Metric (SI) units of measure may be used in WES reports. However, if U. S. customary units of measure are used, the report must contain some means of converting them to the metric (SI) system. If the report is short and/or the number of U. S. units few, metric (SI) equivalents can be given in parentheses immediately after the U. S. unit. Otherwise, a conversion factors table will be used (see Figure 7). Conversion factors shall be taken from ASTM Designation: E 380-76⁶, *Standard for Metric Practice*, issued in September 1977. Conversion factors should generally be listed alphabetically.

22. *Key.* A Key is a page listing designations of proprietary products and/or equipment that should not be mentioned by name in the text. When a report describes tests or evaluations of specific materials or types of equipment, the author may want to be very restrictive in regard to the use of trade names or names of the manufacturers.

LIST OF FIGURES

No.		Page
1	Mississippi River floodplain and levee system	12
2	Phytoplankton collected during sampling period I, in side channel areas	38
3	Phytoplankton collected during sampling period II, in side channel areas	38
4	Phytoplankton collected during sampling period III, in side channel areas	39
5	Phytoplankton collected during sampling period III, in river border areas	39
6	Zooplankton collected during sampling period I, in side channel areas	41
7	Zooplankton collected during sampling period II, in side channel areas	41
8	Zooplankton collected during sampling period III, in side channel areas	42

LIST OF TABLES

1	Comparison of Numbers of Taxa Found by Missouri Department of Conservation with Those Found by the Waterways Experiment Station	11
2	Results of Analyses of Variance for Side Channels and Stations for Each Sampling Period	15
3	Analysis of Variance for Differences in Mean Number of Benthic Organisms for Primary and Secondary Substrate Classifications	21
4	Mean Difference (Side Channel Minus River Border Area) and Significance by Paired T-Test Characteristics of Fish Collection Made During Sampling Period II	24
5	Overall Mean Differences (Side Channel Minus River Border Area) and Significance for Physicochemical and Biological Variables Based on Collections During Sampling Period III	30
6	Tests for Significant Differences in Side Channels Using Controlling Elevation as Variable	36
7	Selected Fish Species Occurring in Side Channels Grouped According to Primary Habitat Preference	37
8	Habitat Preferences as a Function of Controlling Elevation	43

Figure 6. Example of lists of tables and illustrations

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet per second	0.3048	metres per second
inches	0.0254	metres
pounds (force) per square inch	6894.757	pascals
pounds (mass)	0.4535924	kilograms

Figure 7. Example of conversion factors table

In such cases, the materials or equipment will be referred to in the text as "Product A," "Sample RCD-1," etc., and the designations will be defined in a Key. For the final report, the Key will be printed on red paper; it will not be bound in the report but will be hand-inserted in copies of the report going to persons qualified to receive the Key. The author will indicate which recipients should receive the Key. For identification purposes, the Key will bear the report number and title centered at the top of the page. Figure 8 is an example of a Key.

Technical Report SL-79-		
<u>EFFECTS OF DURATION OF MOIST CURING ON CONCRETE</u>		
KEY		
Manufacturer	Symbol	Product
Lone Star Cement Co. Spocari, Ala.	RC-572 and RC-579	Portland cement, type II
North American Cement Corp. Alsen, N. Y.	RC-555(2)	Portland cement, type II
Bessemer Limestone and Cement Co. Youngstown, Ohio	RC-550(2)	Air-entraining portland blast-furnace slag cement, type IS
Century Cement Co. Rosendale, N. Y.	RC-573	Air-entraining natural cement, type NA

Figure 8. Example of Key

23. Sometimes an author at his option may use a Key for the sake of simplicity or brevity only. In such cases, it will not be printed separately on red paper, but will be bound in the report just before the main text.

MAIN TEXT OR BODY OF REPORT

24. This is the report, all other components being merely adjuncts to this feature. Consequently, the body of the report should be technically complete and self-sufficient. The following paragraphs are intended to bring out a few points that may assist the author in his work.

25. An outline delineating the proposed organization of the material to be presented is an absolute necessity in planning and preparing a good report. In preparing an outline, the author must decide whether a topical or a chronological approach will be used, or perhaps a combination of the two. Generally, the topical approach (telling why and how the study was made and what was learned) is preferred. The topical approach may also include a chronological account of the events leading up to the study or of test procedures, etc. Conversely, the purely chronological approach hinders an author in emphasizing the important features of a study, and is ordinarily used only when a historical account is desired. Regardless of the approach

used, the body of a report will normally have the following major subdivisions:

- a. An introductory section.
- b. For an experimental study, a description of the test apparatus, materials, and procedures.
- c. A discussion or description of what was done, and the information or results obtained.
- d. An analysis or interpretation of the results or findings.
- e. Conclusions and recommendations (see paragraphs 32 and 33).

Sometimes one subdivision is so brief that it can be combined with another (the author should not include a subdivision that tells little or nothing, or is repetitious, just because he is following a preconceived outline).

26. Another means of expediting completion of reports and simplifying their preparation is the report-while-testing procedure. The author may use this procedure to write up each test series as it is finished and prepare pertinent tables and illustrations. Thus, when the investigation is completed, the report is essentially complete. An additional advantage of the report-while-testing procedure is that the test data are analyzed as the study progresses. This may assist the investigator in determining the next steps in the testing program. When an investigation consists of several phases, reports may be prepared on each phase to give the sponsor information as promptly as possible.

Introductory Section

27. The introductory section usually contains background information that the reader needs to understand the rest of the report. It may include: (a) the problem that caused the investigation being reported; (b) the history or theory behind the investigation; (c) mention of other reports or investigations on the subject; (d) the specific purpose or purposes of the investigation; (e) the scope of the investigation; (f) the reason for selecting the method of investigation; (g) definitions of specialized terms; and (h) description of the plan and content of the remainder of the report (this is usually necessary only when the report is rather long and complicated).

28. The Introduction should be written in such a manner as to attract and hold the attention of the reader. To do this, the author should reduce his background material to only the facts that are necessary for an understanding of the problem that led to the investigation. He should make sure that he has covered only the pertinent facts and has presented this material as succinctly as possible. For example, in a report of a model study of a navigation structure on the Warrior River, it is not necessary to present the history of navigation and the other navigation structures on that river. The particular structure should be pinpointed with an explanation of why it is to be built. Include only enough material to acquaint the reader with the background of the study being reported. A good Introduction is essential to a good report. Almost as much thought should go into its preparation as into the analysis of results.

Description of Study

29. When writing the description of the test equipment and materials and the narrative of tests and results, the writer should insure that these sections are

developed in a logical manner, that emphasis is properly placed, and that the material is so arranged that all needless repetition is avoided. If the author knows who his audience will be, he may be able to eliminate details with which they are probably familiar. For example, instruments, equipment, or processes that are very likely known to the majority of readers need not be described in detail; sometimes a footnote telling where a description of them can be found is helpful.

30. The information or results obtained may be presented either along with the various test or investigatory phases or in a separate section following the narrative of each major phase. If a separate section is used, the writer should be careful to avoid repetition of the description of the tests. In a long report involving many tests or phases, a summary of all results may be useful in reviewing and emphasizing the most important findings for the reader.

Analysis

31. A separate section should be devoted to the analysis or interpretation of results in order to provide a clear and logical approach to the conclusions. However, in a short report, the results or findings may be analyzed or interpreted as they are introduced, thus eliminating the need for a separate section. In all instances, the author should follow a genuinely scientific approach in the presentation of his results. He should analyze *all* results and give his reasons for placing more importance on some than on others. In addition, he must present his data objectively, convincing his readers that he has an impartial viewpoint. All of the facts should be explained, including the reasons for using certain information while discarding other data.

Conclusions and Recommendations

32. Conclusions and recommendations must be supported by material included in the text. In writing the conclusions, the author should bear in mind the purposes of the investigation to insure that they have all been covered in some way, even if negatively. Besides specific conclusions, a discussion of additional work needed to expand the knowledge obtained in the investigation may be included in this section.

33. Sometimes it is better to submit recommendations separately, since when they are presented with the conclusions they tend to limit application of the conclusions to one specific problem, whereas the findings may be useful in solving other types of problems. In some cases, very general recommendations for application of the findings may be made, and an example of such an application included.

REFERENCES TO SOURCE MATERIAL

34. If *four* literature references or less are cited in the body of the report, the citations will be included as footnotes keyed to the appropriate portion of the text. If *five or more* citations are used, they will be grouped in a "References" section at the end of the main text and listed by authors in alphabetical-chronological order. In listing a corporate author or organization, list from the larger to the smaller unit (e.g. U. S. Army, Office of the Chief of Engineers). The text will include the author's name and the date of the publication in parentheses unless the reference is pertinent to the sentence. If the author's name is a part of the sentence, then only the date will be

enclosed in parentheses. If it is desired to list pertinent literature that is not referred to in the text, such a list will be labeled "Bibliography," and the entries will be listed alphabetically according to the surname of the author. The Bibliography will be located after, or instead of, the References section following the main text. A combination of two of the methods of citing references may be used. For example, a combination may involve the use of footnotes for three cited references together with a Bibliography. Or a References section may be used in conjunction with a Bibliography. (See pages 60 and 61 for examples.)

35. In general the References or Bibliography should contain only documents that are unclassified, available on loan, and bound in some form. However, bibliographical material for classified references can be listed in WES unclassified reports that are restricted by means of distribution statement B. References or Bibliography should not contain references to correspondence or inter- or intraoffice memoranda that are not suitable for loan. If the author wishes to acknowledge material not suitable for loan, he may do so in the Preface of the report or in footnotes.

36. Bibliographic material for classified references will *not* be listed in WES unclassified reports for unlimited distribution (i.e. those reports covered by distribution statement A). If it is considered essential to cite a classified reference in an unclassified report marked with statement A, the following footnote will be used:

* Classified reference. Bibliographic material for the classified reference will be furnished to qualified agencies upon request.

TABLES AND ILLUSTRATIONS

Tables

37. Tables are generally the best means of presenting numerical data. However, long tabulations in the body of a report detract from its readability. Two means of avoiding long tables while still utilizing the effectiveness of tabular presentations are: (a) place excerpts from long tables in the text, and group the complete tabulations at the end of the report; and (b) break up the long tables into several short tabulations that can easily be inserted in appropriate locations in the text. See paragraphs 55 and 56 for numbering system and format to be used for tables.

Illustrations

38. Good illustrative material in the form of drawings or photos is one of the best and most effective means of presenting information. Illustrations should be carefully selected and prepared to insure that they accomplish their intended purpose. They should reinforce and augment text descriptions or tabulations but generally should not duplicate data and/or descriptive matter also given in detail in the text or in tables.

39. Only those drawings or photos that illustrate the main points or features of a study should be presented. The remainder of the data recorded in graphic, photographic, or computer-printed form can be placed in a separate appendix that might be reproduced in only a few copies for use by the sponsor, if requested, and the few other readers interested in the detailed data. See paragraphs 57 and 58 for format for illustrations.

APPENDIXES

40. Ulman and Gould (1965) describe the uses of appendixes, their arrangement, and the way in which they should be referenced in the main report as follows:

The appendix is a highly useful and important part of the report, even though it is shoved into the background behind the main body. The appendix is the place to put any material that needs to be included in the report but that is not an essential, integral part of the main presentation.

We have stressed the points (1) that every technical communication should be as simple, as short, as unencumbered as it can be and (2) that important ideas should not be buried under a mass of detail. The appendix makes it possible to unload detail information or information of secondary importance from the main presentation, yet still to include it for record purposes or for the sake of those readers who may want it or need it.

Because it plays this role, the appendix is sometimes treated as a dumping ground, and simply thrown together helter-skelter and stuck into the back of the report. It does the reader no good to stumble upon some miscellaneous additional information after he has finished reading the report. He should be given the opportunity of looking up pertinent information while he is reading the related part of the main body. *Thus every section of the appendix should be keyed to the text by a specific reference. Any material that is not connected to the text closely enough to be worth mentioning is not worth putting into the report at all.*

The sections of the appendix [or the appendixes] should be arranged in some rational order, often the order in which they are referred to in the text, and they should be numbered (or lettered) serially.

41. Appendixes may be (a) bound with the main report, (b) issued separately but simultaneously with the main report either in equal numbers or in a limited edition, or (c) published later to add supplementary information acquired after the main report was issued. See paragraphs 63-67 for format and numbering system for appendixes.

42. Some of the types of material that may be included in appendixes issued simultaneously with the main report are:

- a. Illustrations or tables not necessary to an understanding of the main report, or which have been abstracted in the body of the report.
- b. Detailed descriptions of methods or apparatus.
- c. Descriptions of rejected methods or tests that should be included for record purposes.
- d. Theoretical analyses and mathematical derivations that are used in but need not be explained in the body of the report.
- e. Samples of forms, data sheets, etc.
- f. Sample calculations.
- g. Plans or recommendations for future action.

NOTATION

43. A Notation is a system of characters, symbols, or abbreviations used to express technical facts or quantities (e.g., A = area, γ = density, GZ = ground zero).

If symbols and/or unusual abbreviations are numerous, they will be listed alphabetically (Roman first, then Greek) and defined in a Notation. For ease of reference, the Notation will be the last appendix in a report. (Figure 9 is an example page from such an appendix.) Even though symbols and abbreviations are defined in the Notation, they should also be defined when first mentioned in the main text of the report but not thereafter. Also, at the first mention of the first symbol or abbreviation that will be included in the Notation, the following footnote should be added: "For convenience, symbols and unusual abbreviations are listed and defined in the Notation (Appendix)."

INDEX

44. In an extremely long or involved report, an alphabetical index may be included for ease of reference. The index should be as complete as the nature of the report and its probable usage require. (The index herein is an example.)

DISTRIBUTION LIST

45. WES reports will be distributed as widely as interest dictates and security and other legal constraints allow. Initial or primary distribution may include Government agencies and their contractors and grantees, industrial and university technical groups, independent groups, and individuals with specialized knowledge. Primary distribution will be accomplished by TIC according to a distribution list originated by the author and furnished by P&GAD. P&GAD maintains computerized distribution lists and will assist authors and/or technical laboratories in originating specific distribution lists upon request. Numerous standard computerized distribution lists (e.g., Concrete Research, Wave Dynamics, Soil Mechanics, Weapons Effects, etc.) have been originated by WES technical organizations and are maintained by P&GAD. For each WES report, the author should carefully review the established (or proposed) distribution list to insure that all interested agencies will receive copies as well as to eliminate agencies not interested in the information reported. Both foreign (OCE-approved) and domestic exchanges are a part of each standard distribution list for civil works reports in the fields of concrete, hydraulics, and soils. Less than 100 copies are required to honor these exchange agreements. This number of copies is included in all standard lists, but exchange agreements should be honored in special or limited publication distribution whenever feasible. Information concerning foreign and domestic exchange agreements should be completed on WES Form No. 1064 (blue sheet), Figure 15, page 41.

46. As part of the primary distribution, WES will send two (2) copies of reports with classified or other limitations on distribution and twelve (12) copies of reports without distribution limitations to the Defense Documentation Center (DDC), Cameron Station, Alexandria, Va. DDC will accomplish subsequent or secondary distribution of the reports as follows: (a) unlimited distribution reports will be made available to the National Technical Information Service of the Department of Commerce for sale to the general public, and (b) limited distribution reports will be

NOTATION

a	Distance along x-axis, ft
A	Amplitude constant
b	Distance along y-axis, ft
C	Amplitude constant
d	Depth of water
d_a	Water depth a distance "a" from shore
e	Base of natural logarithms
g	Acceleration of gravity
H_{avg}	Average runup height
i	Tsunami intensity
J_0	$J_0()$ Zeroth order Bessel function of the first kind
k	Variable, ft^{-1}
L	Characteristic length of the wave in its direction of propagation
n	Refers to a time, $n\Delta t$
$n()$	Tsunami probability function
r_e	Radius of the earth
t	Time
u	Depth-averaged wave velocity component in the θ direction
v	Depth-averaged wave velocity component in the ϕ direction
x	Distance, ft
ΔS	Dimension of a boundary cell face normal to the boundary
Δt	Length of a half-time step
ϵ	Phase factor
η	Wave elevation from reference water level
θ	Latitude measured from the north pole
ϕ	Longitude measured from Greenwich
ω	Wave frequency, sec^{-1}
∂	Partial differential

Figure 9. Example of Notation

distributed subject to the limitations imposed by the sponsoring agency. Also as part of the primary distribution, one to three (1 to 3) copies of WES reports will be placed in the WES Library.

47. A copy of the distribution list will not be included in WES reports unless specifically requested by the sponsoring agency. If included, it will be the next-to-last item in the report, followed only by a facsimile of the catalog card for the report (see paragraph 48).

CATALOG CARD

48. Each WES report will be cataloged by TIC in accordance with Library of Congress standards, and a facsimile of the catalog card will be prepared for inclusion as the last page in each report (see last page of this Guide).

PART III: FORMAT AND STYLE

49. "Format" is defined as the general makeup of the report, and involves such items as page size and numbering, paragraph numbering, systems of headings, the arrangement of tables and illustrations, and the arrangement of lists of references or bibliographies. See Appendix D for the mechanics of format. "Style" is the plan followed in dealing with such details as spelling, capitalization, punctuation, and abbreviations.

FORMAT FOR PRELIMINARIES AND MAIN TEXT

Page Numbering

50. The first right-hand page after the cover in each WES report will be a completed DD Form 1473, Report Documentation Page. It will not bear a page number. All preliminary pages and main text pages will be numbered consecutively at the bottom center in Arabic numerals. *Odd-numbered pages* will be *right-hand pages* and *even-numbered pages* will be *left-hand pages*. Both sides of the page will be used to the maximum extent practical. A page requiring folding will be a right-hand page, and the back of a foldout page will be counted in the page numbering even though it is blank.

51. The pages used for illustrations or tables within the text are numbered if the illustration or table does not occupy the entire area (6 by 9 in.) available for printed or typed matter. If there is no space for the page number, it is omitted but the page is counted. When tables or illustrations follow the main text in a group, there is no necessity for a page number.

Paragraph Numbering

52. Paragraphs of the main text will be numbered consecutively with Arabic numerals. Paragraphs of the Preface (and Summary, if used) are not numbered. Subparagraphs are not numbered, but instead are preceded by an underlined lowercase letter followed by a period.

Headings

53. The use of headings is helpful to the author by affording him a framework for his text, and to the reader by signifying a change in subject. However, headings must be descriptive to be of any value; such uninformative words as "General" or "Discussion" should not be used alone as headings. Too many headings may detract from the text, making it choppy and repetitious rather than a smooth narrative. Authors are cautioned to be consistent in the use of headings, and to be sure that headings of the proper weight are used for the various sections of the report.

54. The heading system for WES reports is illustrated by the headings used in this Guide. The primary breakdown is into "Parts," e.g. "Part I: Introduction," "Part II: Materials Tested," etc. Parts are further broken down by means of center headings, side headings, and paragraph headings. If further subdivisions are necessary, they take the form of subparagraphs and sub-subparagraphs. The various parts of a report should not contain side headings unless center headings have first been used; they

should not contain paragraph headings unless side headings have first been used. Also, each heading should have at least one additional corresponding heading; that is, under a given center heading, there must be at least two side headings or else side headings will not be used under that particular center heading. A short report may be arranged with center headings as the primary division and side headings as the secondary division.

Tables

55. All tables, except brief listings or descriptive tabulations incorporated in the text, will be numbered (Arabic) and given a descriptive title for convenient reference. Generally, they are grouped at the end of the text. The brief tabulations mentioned above are not numbered, do not have an overall title, and are generally referred to only once whereas numbered tables may be referred to several times in the course of the report. (See pages 57 and 58 for examples of in-text tabulations.)

56. Each column in a table must have a heading; if no common heading for all the items in a column is possible, the table should be broken up into several tables or several subdivisions that will permit the use of headings. Units of measurement should be shown in either the column headings or the title of the table. Figure 10 is an example of a well-organized table.

Illustrations

57. Three types of illustrations are used in WES reports: Figures, Photos, and Plates. Figures are usually incorporated in the text and generally consist of such items as vicinity maps, photographic or schematic illustrations of special pieces of equipment, photographic illustrations of test procedures, etc.* Photos are grouped at the end of the text and generally illustrate test data or results such as flow conditions at various discharges, condition of test lane after various amounts of traffic, etc. (Figure 11 is an example of a good photograph.) Plates are line drawings that are grouped at the end of the text and generally consist of diagrams of the model layout or test section, plots of test results, etc. Generally, P&GAD will provide the drafting support for all illustrations to be used in WES reports.

58. Because drawings often make up a major part of a report, considerable care should be taken in their preparation. Figure 12 is an example of a good line drawing. The author should make the drawing titles concise, specific, and informative (though not complete statements). He should see that the title of each drawing is distinctive (i.e. no two drawings should have exactly the same title). The author should combine several plots or curves on one plate if possible; this is not only more economical but also permits better comparison of data. Drawings may be prepared on an automatic data processing plotter, either in finished form or in the form of curves to which lettering, border, legend, etc., can be added by a draftsman.

59. Standard size drawings and lettering should be used throughout reports. In the interest of economy, every effort should be made to insure that drawings are page size or less. If this is not possible, folded sheets may be used. A separate volume is sometimes the most convenient method of handling a number of oversize drawings.

* When the text of a report is very short but many figures are to be included in the report, figures will be placed at the end of the text, following tables (if any). These pages will not be numbered.

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Table 3
Summary of Soil Conditions at 1968 and 1969 Sites, Memphis and Vicksburg Districts

Revetment Site Location	No.	Miles Above Head of Passes	Date	Boring		Overburden Thickness ft	Zone A Thickness** ft	R Value	Predictions†	
				No.	MAHP*					
Memphis District, 1968 Borings										
New Madrid Bend, Mo.	213	882.8 to 880.9	Mar 1968	13	882.8	54	0	0.00	U	
				14	882.5	56	2	0.06	U	
				15	882.2	56	5	0.22	U	
				16	882.0	60	0	0.00	U	
				17	881.7	76	0	0.00	U	
				18	881.4	61	0	0.00	S	
				19	881.2	51	1	0.17	S	
				20	881.0	51	0	0.00	S	
				21	880.9	53	0	0.00	U	
Blaker Towhead, Tenn.	214	843.8 to 842.6	Apr 1968	7AU	843.8	79	15	29	0.52	U
				8AU	843.6	79	61	0	--	S
				G	843.6	62	51	11+	--	NP
				F	843.5	66	34	32+	--	NP
				9AU	843.4	70	30	40+	0.75	U
				H	843.4	66	39	27+	--	NP
				A	843.3	67	29	38+	0.76	U
				10AU	843.2	75	20	52+	0.38	U
				B	843.1	64	22	42+	0.52	U
				11AU	843.1	60	8	28	0.29	U
				C	842.9	64	15	28	0.54	U
				12U	842.8	58	5	38	0.13	U
				D	842.8	61	3	34	0.09	U
				13U	842.7	58	2	43	0.05	U
Ensley, Tenn.	215	720.4 to 720.1	Apr 1968	E	842.6	62	12	28	0.43	U
				14U	842.6	68	24	26	0.92	S
				29	720.4	75	35	38	0.92	S
				30	720.2	67	34	24	1.42	S
				31	720.1	71	49	18	2.72	S
Vicksburg District, 1968 Borings										
Cracraft, Ark.	216	508.55 to 507.95	May 1967 Jan 1968	C-12-68	508.55	62	13	27	0.48	U
				C-7-68U	508.45	61	12	38	0.32	U
				C-9-68U	508.20	62	14	29	0.48	U
				C-11-68U	508.10	61	19	23	0.83	U
				C-10-68U	507.95	62	22	44+	0.50	U
Mayersville, Miss.	217	500.85 to 499.30	Sep and Oct 1967	M-1-67U	500.85	112	34	21	1.62	S
				M-2-67U	500.70	101	24	15	1.60	S
				M-3-67U	500.55	101	25	8	3.13	S
				M-4-67U	500.35	101	59	20	2.95	S
				M-5-67U	500.20	202	58	57	1.02	S
				M-6-67U	499.95	101	19	55	0.35	U
				M-7-67U	499.80	101	35	13	2.69	S
				M-8-67U	499.65	101	8	22	0.36	U
				M-9-67U	499.50	101	45	39	1.15	S
				M-10-67U	499.30	131	16	18	0.89	S
Baleshed, La.	218	485.30 to 484.20	Sep and Oct 1967	B-1-67	485.30	136	3	78	0.04	U
				B-2-67	485.10	91	2	67	0.03	U
				B-3-67	484.90	91	9	54	0.17	U
				B-4-67U	484.75	91	8	21	0.38	U
				B-5-67	484.55	91	0	38	0.00	U
				B-6-67	484.40	141	0	24	0.00	U
				B-7-67	484.20	91	3	60	0.05	U
Goldbottom, Miss.	219	390.20 to 386.80	Aug to Dec 1967	GB-16-67	390.20	91	2	72	0.03	U
				GB-17-67	390.00	146	4	71	0.06	U
				GB-18-67	389.80	91	10	44	0.23	U
				GB-19-67	389.60	91	14	60	0.23	U
				GB-20-67	389.40	91	0	74	0.00	U
				GB-21-67	389.20	91	0	74	0.00	U
				GB-22-67	389.00	91	0	91+	0.00	U
				GB-23-67	388.80	91	0	84	0.00	U
				GB-24-67	388.60	131	0	94	0.00	U
				GB-25-67	388.40	91	9	35	0.26	U

(Continued)

- * Miles above Head of Passes (1962 mileage).
** Plus symbol indicates boring did not completely penetrate the zone A sand stratum.
† U = unstable; S = stable; NP = no prediction possible.

Figure 10. Example of a well-organized table

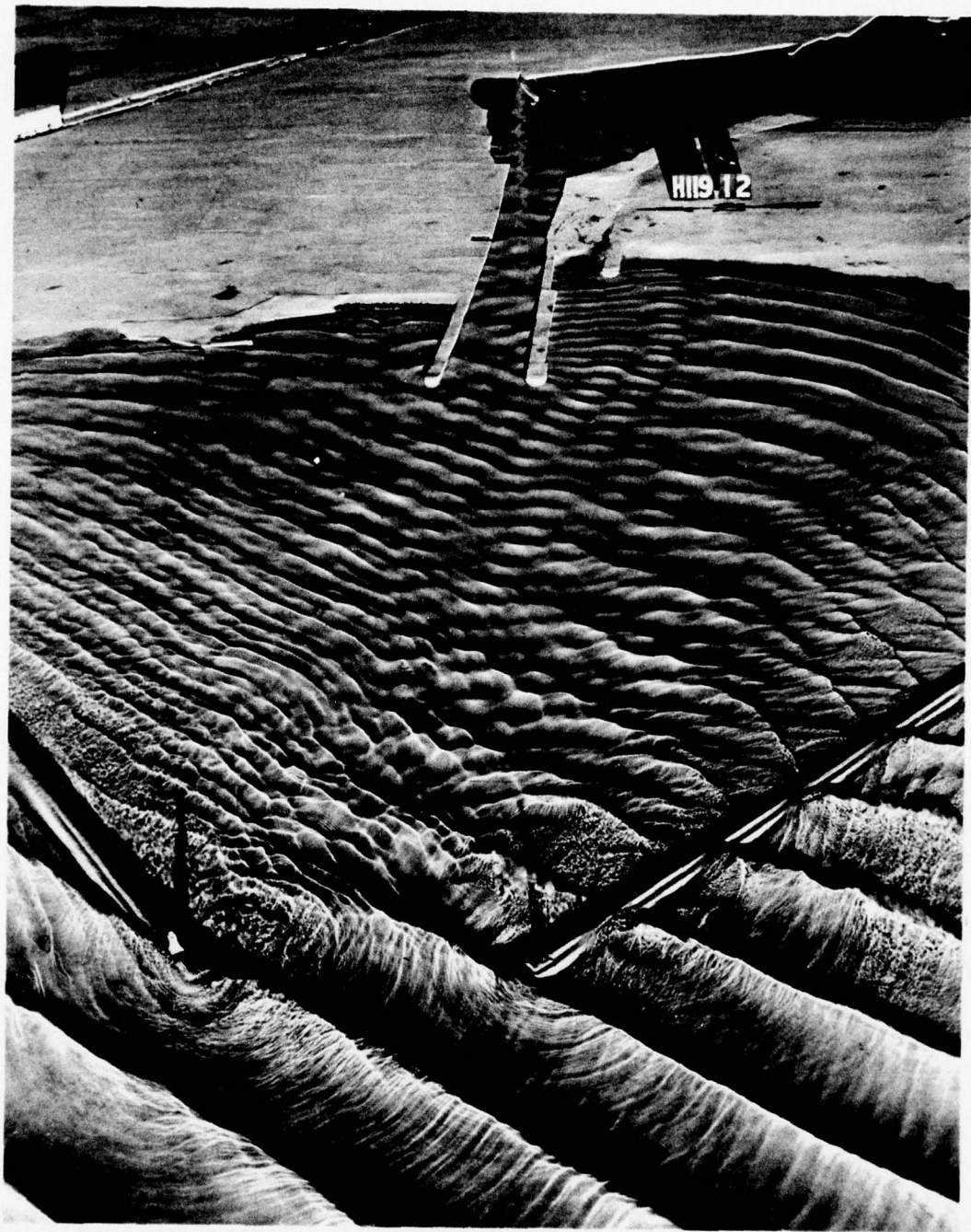


Figure 11. Example of a good photograph

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDG

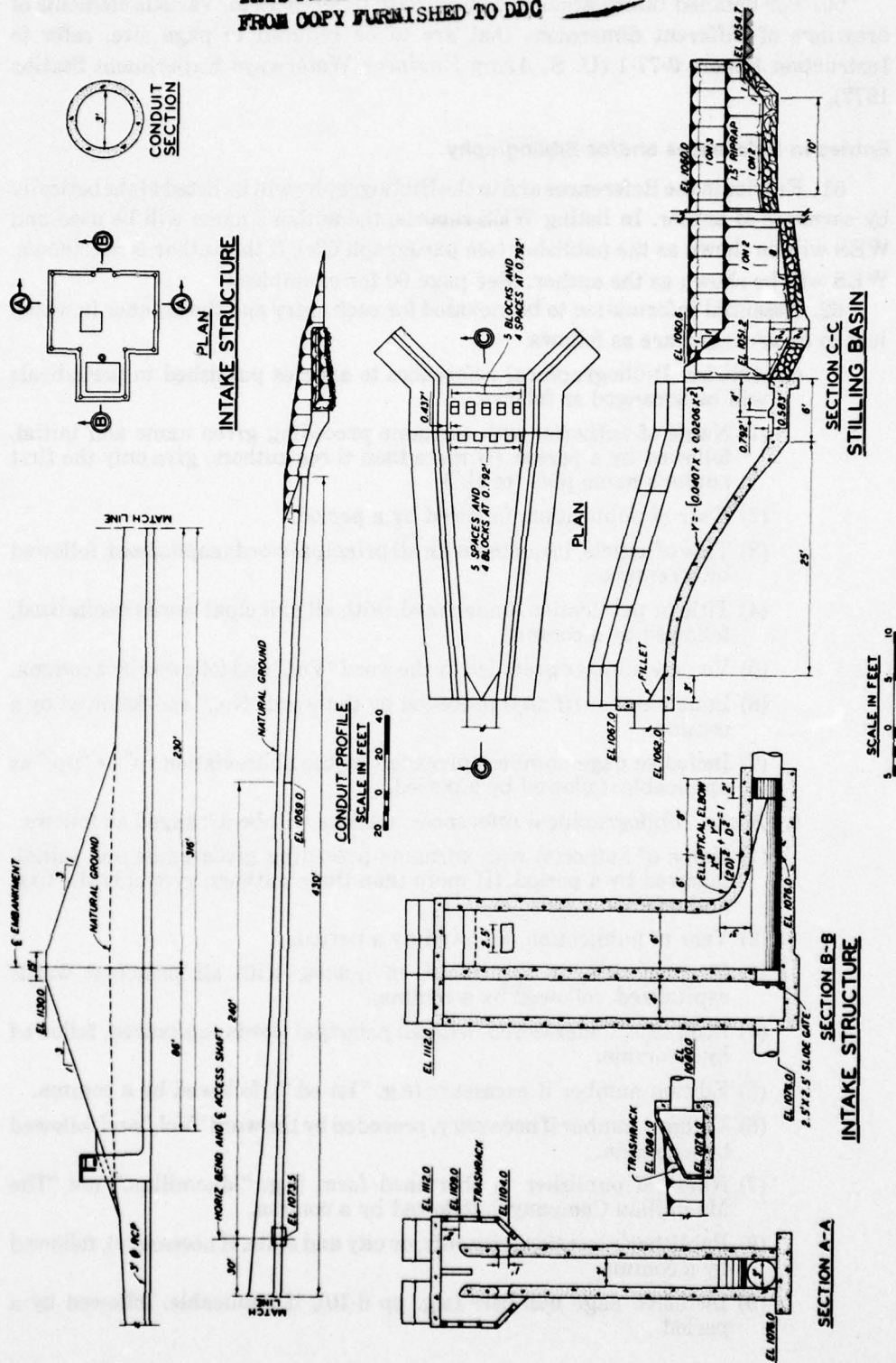


Figure 12. Example of a good line drawing

60. For detailed information on appropriate letter sizes for various elements of drawings of different dimensions that are to be reduced to page size, refer to Instruction Report 0-77-1 (U. S. Army Engineer Waterways Experiment Station 1977).

Entries in References and/or Bibliography

61. Entries in the References and in the Bibliography will be listed alphabetically by surname of author. In listing WES reports, the author's name will be used and WES will be shown as the publisher (see paragraph 62c); if the author is not known, WES will be shown as the author. (See page 60 for examples.)

62. Essential information to be included for each entry and the manner in which it is to be arranged are as follows:

a. *Articles.* Bibliographical references to articles published in periodicals will be arranged as follows:

- (1) Name of author(s) with surname preceding given name and initial, followed by a period. (If more than three authors, give only the first author's name plus "et al.")
- (2) Year of publication, followed by a period.
- (3) Title of article, in quotes, with all principal words capitalized, followed by a comma.
- (4) Title of publication, underlined, with all principal words capitalized, followed by a comma.
- (5) Volume number preceded by the word "Vol," and followed by a comma.
- (6) Issue number (if any) preceded by the word "No.," and followed by a comma.
- (7) Inclusive page numbers preceded by the abbreviation "p" or "pp," as applicable, followed by a period.

b. *Books.* Bibliographical references to books will be arranged as follows:

- (1) Name of author(s) with surname preceding given name and initial, followed by a period. (If more than three authors, give only the first author's name plus "et al.")
- (2) Year of publication, followed by a period.
- (3) Chapter title, if applicable, in quotes, with all principal words capitalized, followed by a comma.
- (4) Book title, underscored, with all principal words capitalized, followed by a comma.
- (5) Edition number if necessary (e.g. "1st ed."), followed by a comma.
- (6) Volume number if necessary, preceded by the word "Vol," and followed by a comma.
- (7) Name of publisher in shortened form (e.g. "Macmillan," not "The Macmillan Company"), followed by a comma.
- (8) Publisher's location (city only, or city and state, if necessary), followed by a comma.
- (9) Inclusive page numbers (e.g. pp 6-10), if applicable, followed by a period.

- c. *Technical reports, pamphlets, etc.* Bibliographical references to technical reports, pamphlets, etc., will be arranged as follows:
- (1) Name of author(s) with surname preceding given name and initial, followed by a period. (If more than three authors, give only the first author's name plus "et al.")
 - (2) Year of publication, followed by a period.
 - (3) Title of report or pamphlet, in quotes, with the principal words capitalized, followed by a comma.
 - (4) Designation and/or number of report or pamphlet, followed by a comma.
 - (5) Name of publisher, followed by a comma; if the publisher is the same as the author it is not necessary to repeat the name.
 - (6) City and state in which the volume was published, followed by a period.
- d. *Transactions or Proceedings.* Bibliographical references to transactions or proceedings will be arranged as follows:
- (1) Name of author(s) with surname preceding given name and initial, followed by a period. (If more than three authors, give only the first author's name plus "et al.")
 - (2) Year of publication, followed by a comma.
 - (3) Title of article, in quotes, with all principal words capitalized, followed by a comma.
 - (4) Identification (underlined) of the Transactions or Proceedings (e.g. Proceedings of the Symposium on Interaction Between Fluids and Particles), followed by a comma.
 - (5) Name of the society (spelled out in full), followed by a comma.
 - (6) Volume number preceded by the word "Vol," and followed by a comma.
 - (7) Inclusive page numbers preceded by the abbreviation "p" or "pp," as applicable, followed by a period.

FORMAT FOR APPENDICES

63. Appendixes in WES reports will be designated by capital letters (Appendix A, Appendix B, etc.). Each appendix will have its own page numbering system, being differentiated from like-numbered pages in the main text by the use of a prefix letter corresponding to the letter designation of the appendix. For example, the first page of Appendix A will be numbered A1. (The appendixes herein can be used as examples.)

64. Paragraphs in appendixes will be numbered consecutively with Arabic numerals, i.e., the first paragraph in each appendix will be numbered "1." Subparagraphs will be identified by an underlined lowercase letter followed by a period.

65. Headings in appendixes will be in accordance with the procedures described in paragraphs 53 and 54 for the main text.

66. Tables and illustrations (Figures, Photos, and Plates) in appendixes will be numbered serially with Arabic numerals preceded by the letter designation of the

appendix (for example, Table A1, Figure A1, etc.). Generally, requirements for main text tables and illustrations are also applicable to appendix tables, tabulations, and illustrations.

67. References in the appendixes will be added to the References at the end of the main text. The first reference citation in each appendix should be footnoted with an explanation of where the References section is located.

STYLE

Spelling

68. *Webster's Third New International Dictionary* (1976) will be used as the primary authority in matters of spelling and hyphenation of words. When equal variants of spelling are given, one will be used consistently in the same report. The Government Printing Office *Style Manual* (1973) also contains excellent sections on spelling and compound words. A list showing the preferred spelling of difficult or uncommon words used in WES reports is included herein as Appendix A. These words are often troublesome because of the confusion regarding whether they are one-word or two-word forms, hyphenated or unhyphenated, etc. WES authors and P&GAD draftsmen will refer to this list when preparing illustrations.

Capitalization

69. The generally accepted rules of capitalization, summarized in Webster's Unabridged, will be followed. Special uses of capitals in WES reports are as follows:

- a. *All capitals.* Part titles, abbreviated forms of proper names (e.g. DNA, OCE, AMC, WES, etc.).
- b. *Initial capitals.* Major words of center headings, major words of titles, subtitles, and column headings of tables, trade names, military project or operation names, and the words "Appendix," "Part," and "Section" when followed by a letter or number. (Note that the words "Figure," "Table," "Photo," "Plate," "Reference," and "Equation" are all capitalized when followed by a number.)

Punctuation

70. Discussion of the rules for punctuation is beyond the scope of this Guide. WES authors should consult good standard works such as Perrin's *Writer's Guide and Index to English* (1965), Skillin and Gay's *Words into Type* (1974), and Webster's Unabridged. Specific usages and/or misusages of certain types of punctuation are discussed in detail in Part VI herein.

Abbreviations and Symbols

71. The basic philosophy in the use of abbreviations and symbols in a report is to gain conciseness—but never to impose a hardship in understanding on the reader. In WES reports, essentially three types of shortened word forms are acceptable: units of measure, agency names, and symbols.

72. *Units of measure.* Abbreviations will be used for units of measure in the text when the units are immediately preceded by numerals.

Incorrect:

Current velocity, in fps, was...

Correct:

Current velocity, in feet per second, was..., or

Current velocity was 15 fps...

Internal and terminal punctuation will be omitted in abbreviations, except where such omission may introduce ambiguity. (For example, the period is always used in the abbreviation for "inch"; thus, "in.")

73. Be consistent in both usage and style. It is permissible to spell out words in the text and abbreviate the same words in tables and illustrations. However, the same form must be used consistently in all tabular and illustrative material, and the form adopted for the text must be used consistently in the text material. For example, do not use "20 feet per second" in one place in the text, "20 fps" in another, and "20 ft/sec" in still another.

74. Appendix B is a list of abbreviations commonly used at WES. Though by no means complete, it does include most unit-of-measure abbreviations and other closely related abbreviations used in WES reports. For additional abbreviations refer to the American Standards Association *Abbreviations for Scientific and Engineering Terms* (1941), the GPO *Style Manual* (1973), and Webster's Unabridged.

75. *Agency names.* The first time an agency name is used in the Preface, the Summary, and the text proper, it should be written out and followed by its proper abbreviation in parentheses if it is to be used again therein. Such abbreviations will be written in all capital letters, with no space or periods between the letters. The abbreviations alone may be used thereafter.

Example:

...at the U. S. Naval Radiological Defense Laboratory (NRDL). Further work at NRDL showed that...

Abbreviations for agency names are found in AR 320-50 (Headquarters, Dept. of the Army, 1975).

76. *Symbols.* Typewriters in P&GAD are equipped with keys for reproducing the Greek alphabet, letters in italics, and most conventional mathematical symbols. The Greek letters and mathematical symbols available are shown in Appendix C.

77. Chemical symbols may be used freely in tables and illustrations. In general, clarity to the reader is the controlling rule for these. In the text, symbols should be avoided when the terms constitute only a general reference.

Preferred:

The barium compounds and the nickel and iron alloys were...

Not preferred:

The Ba compounds and the Ni and Fe alloys were...

Symbols for isotopes, using superscript numerals, may be used in the text.

Preferred:

...consisting of barium-36 and iron-23, or

...consisting of ³⁶Ba and ²³Fe

Numerals

78. The following paragraphs list guidelines for the use of numerals in WES reports (Strange and Mather 1966).

79. Spell out all numbers from one through nine (except in tables or lists), with the following exceptions:

- a. Use numerals when the quantity is partly fractional, such as "1.15," "1-1/2 in." (note the hyphen in the second expression). However, fractions standing alone (with no whole number) are usually spelled out, such as "three-fourths of the dam," "half a mile," or "a half mile."
- b. Use numerals with units of measure, such as "2 by 4 in.," "5 psi," etc.
- c. In contrasted statements, if some numbers must be numerals, use numerals for all, such as "2 miles and 16 miles."
- d. In a series of connected numerical statements implying precision, use numerals, such as "2 years 5 months 3 days." The use of numerals (especially the "1") is not recommended for numbers occurring in precise statements similar to the following: "by connecting the two test coils"; "one testing machine."
- e. Use numerals after certain abbreviations that are not units of measure, such as "Vol V," "sta 1."
- f. Use numerals in proportions, such as "a ratio of 1 to 5" or "a 1:10 scale."

80. Use numerals for all numbers of 10 or higher, with the following exceptions:

- a. Do not begin a sentence with a numeral.
- b. Spell out round numbers used in an indefinite sense unless accompanied by some such label as "about" or "approximately," as "a hundred feet or so," "approximately 100 ft."
- c. Spell out numbers of less than 100 that precede another number, as in the following: "fifteen 2-in. rods," but "120 8-in. rods."

81. In expressing percentages, precise figures, etc., use decimals; for example, use "4.5 percent," not "4-1/2 percent."

82. In decimal numbers less than unity, place a cipher before the decimal points, such as "0.65 in.," not ".65 in."

83. Numbers of four figures should not be separated by commas in either text or tabular matter (such as 6418 tons), except when they occur in a column of a table or a paragraph of text containing a number of more than four digits; in these cases the comma is used with the four-digit number for uniformity in that particular column or paragraph.

84. Always use numerals for the time of the day and the day of the month: such as, "2:30 p.m.," "25 January 1913"; but spell out such phrases as "the first of May," when not referring to specific days. Spell the numeral when referring to specific days by ordinal number: "the fifteenth of May."

85. Type fractions "3-1/2" and not "3½."

Mathematical Expressions

86. WES style for presentation of equations and other mathematical expressions is summarized in Appendix C.

PART IV: PREPARATION, PROCESSING, AND DISTRIBUTION OF WES REPORTS

87. A flowchart indicating the usual path a WES report takes in the process of publication is shown in Figure 13. The various steps are discussed in detail in the following paragraphs.

PRELIMINARY PLANNING

88. In order to expedite the publication of a report, the author should: (a) begin planning and writing the report concurrently with his investigation whenever feasible, and (b) obtain the advice and services of P&GAD in planning the report, arranging for timely drafting support, setting up tables of data, and resolving questions of organization, general content, etc.

89. Technical reports should give a complete, accurate account of the work accomplished, but they should contain only information, illustrations, and data essential to an understanding of the subject matter. During the preliminary phase of assembling the material that will go into the report, the author should decide what data are essential and what can be put into appendixes or simply filed. Early determination of what need not be included in the report will save time and money. In the case of computer-printed data, a format should be selected in the beginning that will facilitate assembling the data.

90. When a report is initiated, the "Due Date" column of WES Form 1428 (Figure 14) will be completed in duplicate. The dates for P&GAD work should be based on the time information given in the note at the bottom of the timetable. One copy of this form will be attached to the report and will remain with the report through every preparation and review phase until the report is published. The technical organization will retain the other copy. Each echelon working on the report will make appropriate entries in the "Actual Date" column of the form.

PRELIMINARY DRAFT

Author

91. The engineer or scientist responsible for the preparation of the preliminary draft of a report is also responsible for the completeness, accuracy, and technical sufficiency thereof. Drawings accompanying the preliminary draft may be in preliminary or final form. However, preliminary drawings should be complete, legible, and accurate, and prepared with a view toward final report standards. For economy of time and funds, neat, legible, good-quality pencil drawings may be used in Miscellaneous Papers, and computer printouts of data may be used in all types of reports. The author should bear this in mind in preparing drawings and tabulations, and suggest that this be done if the material seems to him to be adequate.

Laboratory Review

92. After the preliminary draft has been reviewed in the technical organization, WES Form 1064 (Figure 15) will be completed, signed by the division or laboratory

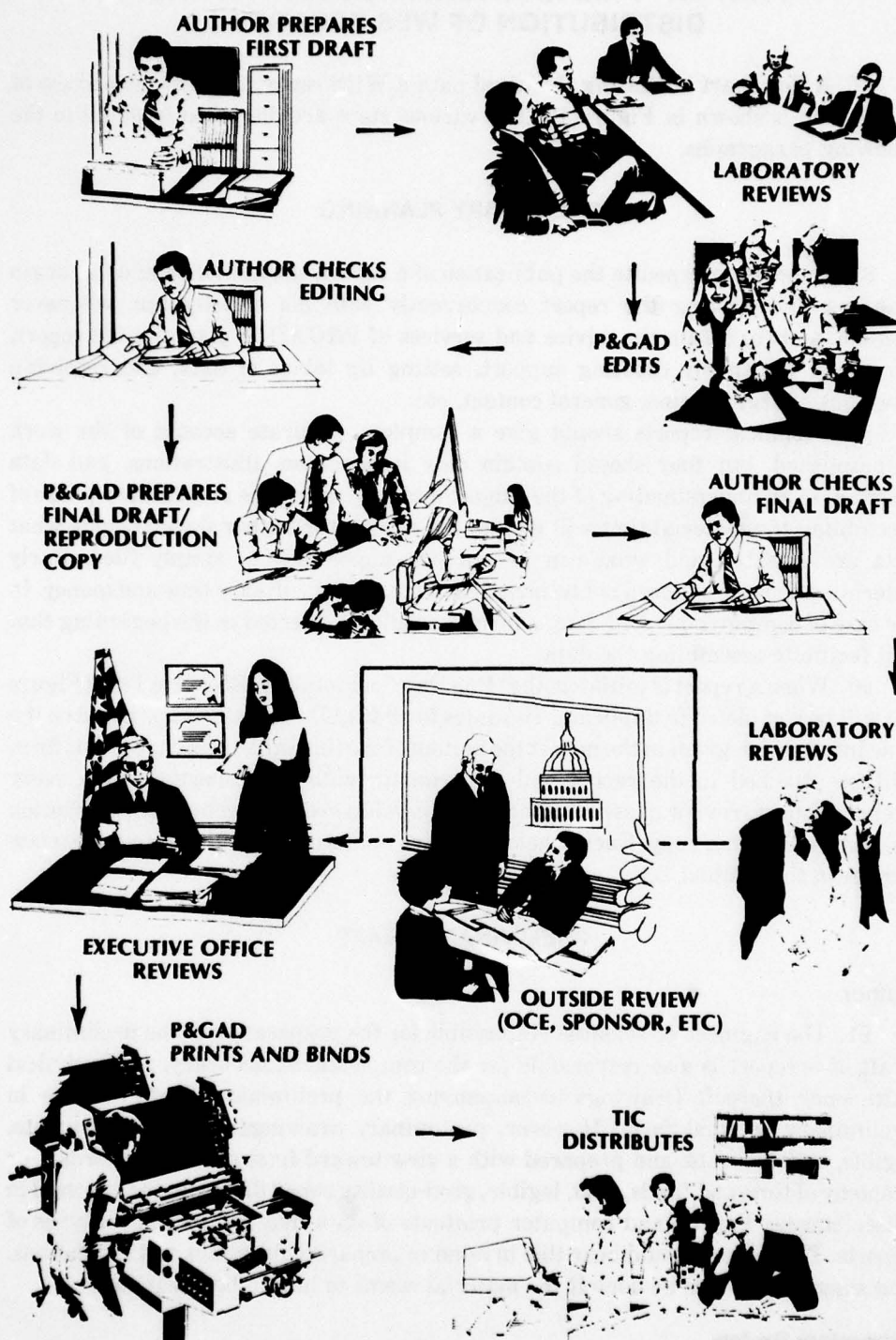


Figure 13. Flow chart for WES reports

REPORT TIMETABLE

Due dates will be filled in to indicate desired deadline or target dates. The form will remain with the report until it is published. Each echelon will fill in actual dates.

Report title: _____

Beginning date: _____

Sponsor-established deadline: _____

	Due Date	Actual Date
1. To Branch Chief:	_____	_____
2. To Division Chief:	_____	_____
3. To Laboratory Chief:	_____	_____
4. To P&GAD for editing:	_____	_____
5. To Author for check of editing:	_____	_____
6. To P&GAD for final draft:	_____	_____
7. Final draft to Author:	_____	_____
8. Final draft to Laboratory Chief:	_____	_____
9. Final draft to Sponsor:	_____	_____
10. Final draft returned by Sponsor:	_____	_____
11. To P&GAD for correction:	_____	_____
12. To TIC for catalog card:	_____	_____
13. To Office of Technical Programs and Plans:	_____	_____
14. To Executive Office for approval:	_____	_____
15. To P&GAD for publication:	_____	_____
16. To Publications-Distribution:	_____	_____

Remarks: _____

Note: Normally one month each should be allowed between items 4 and 5, 6 and 7, and items 11 through 16.

WES FORM No. 1428
Rev SE 1978

Figure 14. Report timetable

INSTRUCTIONS TO P&GAD

(To be filled in by Division or Laboratory Chief when report is sent to P&GAD)

Report title: _____
 Proposed designation: TR _____ MP _____ JR _____ Other _____
 Certain laboratories have domestic and foreign exchange agreements for Civil Works (CW) reports. Is this a CW report suitable for exchange distribution? Yes _____ No _____
 Proposed distribution: General _____ Limited _____ Distribution list to use: _____
 Job No. _____
 Funds available for P&GAD work _____
 Priority in relation to other reports of Laboratory already in P&GAD _____
 Person to contact in Laboratory _____
 Report format and style to use: WES _____ DNA _____ Other _____
 Remarks: _____

Editorial Work to be Done by P&GAD

TYPE 1 EDITING. Editor will check for:

- Effective organization of contents and expression of ideas (i.e., good paragraph and sentence structure, logical progression of ideas, proper emphasis, deletion of redundancies and unnecessary repetitions, clarity, parallelism, consistency, brevity, and best word choice).
- Conformance with format and style specified above.
- Agreement of data in text, Figures, Tables, Photos, and Plates.
- Correctness of grammar.
- Effective and economic use of exhibits.
- Verification of bibliographic references and footnotes.

TYPE 2 EDITING. Same as Type 1 Editing except that editor will not check for agreement of data in text, Figures, Tables, Photos, and Plates.

TYPE 3 EDITING. Editor will check for:

- Logical overall organization of report. (Major structural flaws, if any, will not be changed but will be pointed out to author. Existing sentences and paragraphs will be changed only as necessitated by b, c, d, and e below.)
- Conformance with format and style specified above.
- Correctness of grammar.
- Effective and economic use of exhibits.
- Verification of bibliographic references and footnotes.

TYPE 4 EDITING. Editor will merely check to see that report complies with requirements of AR 70-31; i.e., check to see that report contains proper cover, DD Form 1473, trade names disclaimer (if necessary), Summary (if necessary), Preface, table of contents (if necessary), conversion factor table and footnote, distribution list (required in DNA reports), and facsimile of library catalog card.

NOTE: Standard WES report policy requires either Type 1 or Type 2 Editing for all reports to be given Corps-wide or greater distribution (i.e., more than 30 copies required). Type 3 Editing is acceptable when there is a severe shortage of funds and/or time. Type 4 Editing is acceptable only for reports being bound for filing in WES library or for reports being published in limited quantity (e.g., 3 to 30) for limited distribution.

Copy Preparation Work (and Subsequent Printing) to be Coordinated by P&GAD

- Prepare reproduction copy: _____
- Number of draft copies required: _____
- Number of printed copies required: _____
 Regular _____ Domestic Exchange _____
 Foreign Exchange _____ Total _____
- None _____

Drafting Work to be Coordinated by P&GAD

Have drafting done _____ Have drafting corrected _____ No drafting required _____

(Signature of Division or Laboratory Chief)

WES FORM No.
 Rev DEC 1978 1064

(Over)

Figure 15. Instructions for P&GAD

NOTICES TO GO IN WES REPORTS

(Please check proper notice to use of those in paragraphs 1 and 2)

1. Distribution Statement. Indicate which of the following statements (required by AR 70-31) is to be put on front cover and DD Form 1473 of report. If Statement B is to be used, please indicate which of the four reasons is to be cited.

Statement	Reason for Use	Discussion
<u>A</u>		
() Approved for public release; distribution unlimited.		Indicates document has been cleared for public release by competent authority. It may be made available or sold to the general public and foreign nationals. Never to be used on classified documents.
<u>B</u>		
() Distribution limited to U. S. Government agencies only; (fill in reason); (date statement applied). Other requests for this document must be referred to (insert controlling DoD office).	() Foreign information	May be used on classified documents if necessary to insure distribution limitation in addition to need-to-know requirements or in the event the document is declassified. Information furnished by a foreign government with the understanding that it will not be transmitted outside the U. S. Government.
	() Proprietary information	To protect information not owned by the U. S. Government and not protected by a contractor's "limited rights" statement but received with the understanding that it would not be transmitted outside the U. S. Government.
	() Test and evaluation	Covers the test and evaluation of commercial products or military hardware.
	() Contractor performance evaluation	Management reviews, records of contract performance evaluation, or other advisory documents evaluating programs of contractors.

2. Disposition Instructions. Unless special instructions regarding the report's disposition are necessary, one of the following notices will be used:

Unclassified reports:	() Destroy this report when no longer needed. Do not return it to the originator.
	() When this report is no longer needed return it to the originator.
Classified reports:	() When this report is no longer needed, Department of the Army organizations will destroy it in accordance with procedures given in AR 380-5. Department of the Army contractors will destroy the report according to the requirements of Section 14 of the Industrial Security Manual for Safeguarding Classified Information. All others will return the report to U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 39180.

3. Trade Names Disclaimer. If it is essential that trade names or names of manufacturers of material or equipment be given in the report please indicate below.

- () The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

4. Disclaimer. The following will appear on all reports.

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

chief, and attached to the draft. The report will then be sent to P&GAD for processing.

93. Form 1064 should be filled out carefully and completely. A cost estimate for completion of P&GAD work may be requested if desired. The distribution statement to be printed on the report cover should be selected from those on the back of the form; the reason for the selection of Statement B should also be shown. The "controlling DoD office" is the office selecting the statement, and may be WES or the sponsor. If Statement B is used, it shall remain in effect until changed by the controlling office (see paragraph 111).

P&GAD Review

94. When a report comes to P&GAD for processing, it will be reviewed to determine what procedures will be necessary to meet deadlines or target dates. Any questions will be taken up with the person designated on Form 1064. The report will then be edited if required. (For details of the P&GAD editing function, see Part V.)

Author's Check of Editing

95. The edited draft will be returned to the author for check of editing. On completion of this check, the draft will be returned to P&GAD for preparation of the reproduction copy/final draft.

FINAL DRAFT

P&GAD

96. P&GAD will prepare the final draft of the report in accordance with current standards of format, arrangement, and style. A sufficient number of copies of the final draft will be prepared for final review (a single copy if it is to be reviewed only at WES, or several copies if it is to go to the sponsoring office, consultants, etc., for review).

Technical Organization

97. The final draft will be thoroughly and carefully checked in the technical organization to insure the accuracy and adequacy of the completed report. Copies of the final draft will then be forwarded to the sponsor or other office as required (see following paragraph), to consultants, or back to P&GAD if outside review is not required.

Sponsoring Office

98. The final draft will be forwarded to the sponsoring office for review if requested by that office, if required by ER 70-2-3 (Headquarters, Dept. of the Army, 1973) or by ER 70-3-6 (Headquarters, Dept. of the Army, 1972), or if considered desirable by the WES technical organization concerned. The cover page of the report will be typed on a sheet with "DRAFT" printed on it in black ink if the report has been edited by P&GAD and reviewed as required in the technical organization. If the report has not been so edited and reviewed, the cover page will be typed on a sheet with "PRELIMINARY; WORKING DRAFT ONLY; SUBJECT TO INTERNAL

REVIEW AND EDITING" printed on it in red; also, each page of the text will be typed on sheets with "WORKING DRAFT" printed in red at the bottom.

99. The letter forwarding the draft will call attention to the proposed distribution list included in the draft and the distribution statement appearing on the cover page, and request concurrence. It will also ask how many copies of the report the sponsor desires if this has not already been established. The letter will also request that the report be returned promptly. When the draft is returned to WES, it will be routed to the technical organization concerned, where any necessary changes will be made, and then to P&GAD with any additional or revised information on distribution or restrictions.

Executive Office Review

100. P&GAD will submit final drafts of all reports to the Technical Director for review and final approval prior to publication. These drafts will include any changes made by the sponsoring office or consultants.

Final Reproduction

101. Upon receipt of the approved draft, P&GAD will make any final changes in the reproduction copy prior to printing. The printed copies of the report will be delivered to TIC for distribution.

EXCEPTIONS TO PROCESS DESCRIBED THUS FAR

Miscellaneous Papers and Instruction Reports for Limited Distribution

102. Miscellaneous Papers and Instruction Reports that will receive only *limited* distribution (30 copies or less) need not follow all the channels prescribed thus far. In addition, they need not be as finished in style or format as technical publications given wide distribution. However, they should conform to the usual requirements of technical and grammatical sufficiency, and all illustrations and tables should be neat and legible. Even though these reports will receive only limited distribution, they must be reviewed and approved by the Technical Director before being printed.

Contractor-Prepared Reports

103. Contractor-prepared reports must be reproduced at WES from reproduction copy prepared by the contractor, or from reproduction copy prepared at WES from a draft furnished by the contractor. Government Printing and Binding Regulations published by the Joint Committee on Printing, Congress of the United States, specifically states that research contractors shall not become prime or substantial sources of printing. Paragraph 35-1 of the regulations reads as follows: "The inclusion of printing...within contracts...for services such as...engineering, and research, is prohibited unless authorized by the Joint Committee on Printing." The contract will specify the format for the report, which will be that prescribed for WES Technical Reports (except DNA reports) in regard to spacing, page size, use of both sides of sheets, keeping illustrations to the minimum necessary for a clear

understanding of the subject matter, and making illustrations page size or smaller whenever possible. In addition, contractor-prepared reports will contain the proper distribution and disposition statements and a completed DD Form 1473. In reviewing drafts of contractor-prepared reports, the responsible laboratory will insure that the final reproduction copy meets the following requirements. The Preface will include the sponsoring agency, statements indicating authorization for the work, numbers and titles of the DA Project/Task under which the work was accomplished, and the relation of the work to the overall program. It will also include the following statement, generally as the last paragraph: "The contract was monitored by Mr. _____, _____ Branch, _____ Division, of the _____ Laboratory of the Waterways Experiment Station. Contracting Officer was COL _____, CE." Other WES personnel, such as branch, division, and laboratory chiefs, may be named at the discretion of the laboratory chief concerned. The reproduction copy of contractor-prepared reports to be published by WES must be typed on white bond paper, drawings must be neat, legible, and preferably suitable for reduction to a 6-by 9-in. size or smaller, and photographs must be good, continuous-tone prints. The reproduction copy will be furnished to P&GAD for printing. All contractor-prepared reports will be bound with the prescribed WES cover (see Figure 3), which will show the contract number and name of the contractor. The Form 1473 will also contain the contractor's report number and any other information desired by the contractor. *Guide for Preparation of Waterways Experiment Station Contract Reports* (U. S. Army Engineer Waterways Experiment Station 1974) contains additional information on contractor-prepared reports. These reports will be distributed by TIC. Up to 25 copies of a report may be furnished to the contractor.

**Reports Prepared by
WES but Printed Elsewhere**

104. Reports prepared by WES technical organizations but printed by the sponsoring office will also be incorporated in the appropriate WES report series. At least three copies of the published edition of all such unclassified reports (a maximum of two copies of classified reports) will be forwarded to P&GAD, which will assign a report number, have a WES cover attached over the sponsor's cover, and send them to TIC for filing.

**Reports Prepared for
Record Purposes Only**

105. Reports prepared for record purposes only (no distribution except to TIC Library and possibly to technical organization involved) will be designated Miscellaneous Papers and filed in the Library, provided their content will not be included in a future, more comprehensive report. These reports should contain a Preface, or at least an introductory paragraph, giving the administrative background, pertinent dates, and any acknowledgments desired. At least three copies of such reports will be sent to P&GAD with a Form 1064 showing distribution statement to be printed on cover (for TIC use). P&GAD will assign a report number,

have report bound, and send it to TIC. A few copies for files of the technical organization concerned can be bound at the same time, if desired.

**Papers Prepared for
Professional Societies and/or Journals**

106. Papers prepared for presentation at symposiums or meetings of professional societies will be bound as a WES Miscellaneous Paper unless the paper is based on information that is or will be available in another WES publication. Clearance for presentation of such papers will be obtained in accordance with provisions of WES Station Regulation 360-1-2.

107. After a paper is presented, the author should furnish TIC the following: title, author, date, location and place in which it was presented, probable publication date and journal, and the availability of reprints.

Theses and Dissertations

108. In most cases, theses and/or dissertations completed by WES employees as a result of Corps-sponsored academic work will be published as a formal WES report. As such, they will be subjected to most of the normal WES report publication policies and procedures described herein. For information on the handling of theses and/or dissertations that are not published as formal WES reports, see WES SR 350-1-3.

DISTRIBUTION OF WES TECHNICAL PUBLICATIONS

109. Technical publications are normally distributed by TIC, which keeps a record of the number of copies received, primary distribution made, and any foreign recipients.

110. Numerous standard computerized distribution lists for WES reports are maintained by P&GAD. Both foreign and domestic exchanges are designated on these lists and should be honored whenever possible. For reports for which one of the standard distribution lists is not appropriate, the author or technical organization will originate a list for forwarding with the final draft, taking into consideration the established foreign and domestic exchanges (approximately 100 copies required).

111. Except for reports published in only a few copies, 12 copies of all unclassified, unlimited distribution (Statement A) reports and 2 copies of limited distribution (Statement B) reports will be forwarded to DDC on initial distribution. If Statement B was used on a report, it will remain in effect until changed by the controlling DoD office. When notified by the controlling DoD office that Statement B can be removed, TIC will notify primary distribution recipients and cognizant document handling facilities that Statement A should be applied (AR 70-31).

PART V: THE WRITING/EDITING FUNCTIONS

112. The purpose of a technical report is not only to record the results of an investigation, but also to present the details and associated reasonings in a form that is easily referred to and readily understood by the audience for which the report is intended. With this basic purpose of reports in mind, the following discussion of the writing and editing functions as practiced at WES was compiled.*

THE WRITING FUNCTION

Duty of Writer

113. The primary duty of a technical writer is to convey information accurately and clearly. However, many writers seem to subordinate this purpose and forget the poor reader when preparing a report. For example, when a reviewer or editor points out that a certain word seems incorrect or ambiguous, the writer may proceed to an unabridged dictionary and triumphantly point out the rare definition that clarifies his sentence. Obviously such an author is more interested in demonstrating his erudition than in presenting information clearly to his harried reader; for if he had his reader in mind, he would try immediately to substitute a more common word.

114. Today nearly every reader of technical literature is in a hurry. He has so much to read that he has to skim nearly everything if he is to get through the daily pile of papers on his desk. He also has to read discontinuously, since the pressures of his job seldom permit him to read a report from cover to cover in one sitting. Therefore from a practical viewpoint, the writer should cater to these needs. He should build ease of reading into his style and format. Actually the job is not so difficult if the writer will use the following suggestions for tailoring the prose and mechanics of his report to the rapid reader:

- a. *Use descriptive headings and subheadings freely.* They act as signposts, group related material, and show the interrelation of the parts and their contribution to the whole. Newspapers use headings, why not reports?
- b. *Put the topic sentence at the beginning of a paragraph.* This gives the reader a choice. He can either read the details on the topic or skip to the next paragraph.
- c. *Use a simple structure for a complex idea.* Whenever the thought is involved or otherwise difficult to describe, the grammatical structure should be simple. Three short sentences are easier to read in this case than one long one; a paragraph of technical description more than a page long usually has to be reread.
- d. *Relegate secondary material to an appendix.* Main ideas will stand out if not buried by incidentals, however pertinent.
- e. *Make full use of visual aids.* Curves and tables that summarize detailed results are invaluable. Most readers have trained themselves to extract the information they need, at a glance. But always supply captions and legends, and refer to the illustration or table at that point in the text where the reader needs the information.

* This discussion was compiled in great measure from *Technical Editing*, by B. H. Weil (1958); *Clarity in Technical Reporting*, by S. Katzoff (1964); and *Writing and Editing Reports*, by R. R. Rathbone (1961).

The following paragraphs give helpful suggestions in regard to word usage, sentence structure, and paragraphing.

Choice of Words

115. Avoid using a rare word unless it is essential. Foreign words and phrases should not be used; whatever elegance or subtlety they may add to your paper or report is probably lost on your reader, who will merely find the paper or report that much more difficult to follow. Technical words commonly used in a particular branch of science or engineering can, of course, be used. Be sure, however, that the technical words are not merely WES jargon, because such language can be meaningless to workers at another laboratory.

116. The need for precise, straightforward language cannot be overemphasized. The reader is after information, not an emotional experience. He asks for clarity and efficiency of expression, not impressive language. Other things being equal, choose: (a) a short rather than a long word; (b) a plain, familiar word rather than a fancy, unusual one; and (c) a concrete word rather than an abstract one. Some major word faults are illustrated below:

Fuzzy words:

Plates of *appreciable* thickness...
A *relatively high* temperature...
A *small number* of failures...

Overformal words:

Conditions should *ameliorate* as soon as the maintenance crews are *inculcated* in the theory of operation.

Jargon and coined words:

The system can be introduced with *effectivity* within six months. All the components are *ruggedized*.

Cliches:

Last but not least, we intend, *in the long run*, to *explore every avenue* that might lead us to a solution *along this line*.

Sentences

117. For sentences, "do" and "don't" suggestions are not as simple and obvious as those just presented for words. However, the basic purpose of presenting your material as clearly as possible is still your guide.

118. The length of a sentence should generally not exceed about 35 words, unless it is broken up (as by semicolons) into two or three distinct and logically consecutive parts. Simple sentence structure requiring a minimum of punctuation is desirable. Longer, more complex sentences should be used less frequently to lend variety, rather than as the primary means of expression.

119. An equally important suggestion is that a sentence should generally contain some indication of how it is related to the preceding sentence or to the development of the paragraph. This indication is usually near the beginning of the sentence. For example, in the first three sentences of this paragraph, the opening phrases ("An equally important suggestion," "This indication," and "For example") all serve to show

relation to what has gone before. Omitting such tie-in wording may not essentially alter the main content of the sentence, but it forces the reader to figure out for himself how the sentence fits into your train of thought.

120. Make every effort to eliminate ambiguous phraseology from your sentences. Unfortunately the English language offers many opportunities for ambiguity. Ask yourself as you write each word, phrase, or sentence whether its meaning will be clear or whether it has a chance of being even momentarily misunderstood.

121. Sometimes the reader may attach undue weight to a statement simply because the writer was not careful in separating and labeling his primary and secondary information. Improper emphasis can, and frequently does, occur at the sentence level. The rule is: *Put main ideas in main (independent) grammatical construction; secondary ideas, in secondary (dependent) grammatical construction.* For example, the writer who says "The solution is best determined by field test and is 50 volts" has assigned equal weight to two ideas. The statement that the value is 50 volts is the more significant, and the following revision would so indicate: "The solution, best determined by field test, is 50 volts."

122. Frequently a particular fact or idea must be stated more than once in a report; for example, it may be given in the introduction and then also in the description of the tests and in the discussion. Rather than treating it every time as brand new material, you might introduce the repetition with a phrase such as "As has already been mentioned," or "Here, again, the fact that..."; otherwise the reader may wonder whether his memory is playing tricks. Such introductory phrases are not always essential, but their omission can sometimes be very annoying.

Paragraphs

123. A paragraph is usually thought of as a group of sentences developing a single topic, but a paragraph may consist of a single sentence. Like the sentence, a paragraph must have unity, coherence, and emphasis. Unity is attained when every sentence bears directly upon the topic of that particular paragraph; any departure from the central topic means that a new paragraph should be formed. A topic sentence (i.e. the sentence that expresses the topic to be discussed) is generally placed at the beginning of the paragraph. However, its position can be varied to avoid monotony. Coherence in a paragraph results from the correct arrangement of the parts of the paragraph—an arrangement in which each part leads to the next. Emphasis in the paragraph results from stressing the important ideas, either by devoting more space to them or by their position in the paragraph; the beginning and the close of the paragraph are the most emphatic positions.

124. The main characteristic of a clear paragraph is that the relation of each sentence to the preceding or following one be clear, as by means of transition words or phrases. In addition, it may be desirable to indicate definitely the relation of each paragraph to the preceding or the following one. Usually the relation to preceding material is indicated in the opening sentence or sentences of the paragraph; and relation to the following material is indicated in the final sentence or sentences of the paragraph. In any case, make sure that your reader is not required to proceed very far into a paragraph (e.g. beyond the second sentence) before the general drift of the

subject matter becomes apparent. Do not make him read on and on while wondering just how the paragraph fits into your report. You, as the author, are in a much better position than is your reader to organize your material; and the responsibility both for organizing it and for showing the organization rests on you.

125. Do not make your paragraphs too long. Just as a sentence with too many phrases is difficult to grasp as a unit, so is the paragraph with too many sentences. A long paragraph should not, of course, be broken up into shorter ones by arbitrary subdivision. If you find your paragraph getting very long, either simplify the idea or break up the idea into smaller units, with a paragraph for each.

THE EDITING FUNCTION

126. Excellent research poorly reported may sometimes be interpreted as of less worth than less significant research that has been well reported. Therefore the careful editing of reports to improve their organization, grammar, etc., enhances their overall quality and subsequent use of the results reported.

Author/Editor Relation

127. Editors are assigned the responsibility of assisting authors in completing reports which reflect both technical competence and the views of management relative to the mission of the Station. If an understanding is reached between editors and authors of the importance and mutual advantages of teamwork, effective technical reports are produced with a minimum of effort.

128. The efforts of technical writers, technical editors, illustrators, and publishers are all ultimately directed toward producing documents suited to the intended readers. This means that the technical editor must keep the needs and interests of the intended readers foremost in mind when he edits each document, and that he must judge and mold the writer's efforts in these regards.

129. Accordingly, the technical editor must remember that readers are "turned off" by overdetailed discussions, vague statements, and overuse of synonyms, unfamiliar jargon, and obscure units. He must also strive to see that documents are as attractively presented as budgets will permit, since many readers react unfavorably to publications that contain long lines of small type (or typing), are poorly duplicated, and are inadequately bound.

130. A P&GAD technical editor is both the junior partner of an author/editor team and a representative of management. Editors are charged with the task of seeing that technical data are reported in a manner suited to the WES mission and within prescribed standards for such publications. It is hoped that this Guide will be helpful in establishing "ground rules" to assist both authors and editors in processing effective technical reports. However, the editor, in order to perform his tasks effectively, must have a ready knowledge of the special language of various sciences in addition to the usual basic knowledge of grammar, punctuation, etc. He must accept the fact that most words have several meanings or exact shades of meaning and learn to identify these meanings with precision.

131. If an author fails to follow prescribed format or rules of presentation as

described herein, the editor can easily refer the author to this Guide. However, matters of literary style are considerably more delicate. It is not the function of the editor to rephrase a report in his own literary style. Usually, style is not the important aspect of a report. A report need only be understandable, readable, written in clear, concise language, and complete.

132. Standardization of format and grammar aids in making the report more understandable. A report must be presented in such a way that technical details are easily interpreted by the audience for which the report is intended.

Functions of P&GAD Editors

133. As already stressed, the job of P&GAD editors is to insure production of accurate, well-written, well-organized, and readily understandable technical reports as efficiently and economically as possible. The general functions of editors are outlined below:

- a. Maintain established publication standards of content, organization, style, and format.
- b. Review reports and/or other documents for proper presentation.
- c. Counsel authors on report problems.
- d. Coordinate the various processes in the publication of reports.

134. In accomplishing these general functions, editors must perform the following, more detailed services:

- a. Correct grammar, punctuation, format, and style.
- b. Indicate or question apparent errors in fact.
- c. Question vague or ambiguous statements, unfamiliar jargon, and obscure units.
- d. Indicate redundancy, repetition, and inconsistencies.

Editors must guard against trying to impose their own preference for words or their own writing style on the author.

135. There are four types of editorial treatment applied to WES reports by P&GAD editors. These types of editing are described in detail on WES Form 1064 (Figure 15). Standard WES report policy requires either Type 1 or Type 2 editing for all reports to be given Corps-wide or greater distribution. Type 3 editing is acceptable when there is a severe shortage of funds and/or time. Type 4 editing is acceptable only for reports being published in limited quantity (30 copies or less) for limited distribution.

Checklist for Authors and Editors

136. A checklist for use by both authors and editors is outlined on the following pages. A review of the checklist should assist in the attainment of a complete and properly organized report.

a. Preface:

- (1) Does the Preface give the necessary administrative background, such as authorization, sponsor, dates when study was started and completed, acknowledgment of personnel of sponsoring office or other agencies who were involved in the study, and WES personnel?

- (2) Does the Preface contain technical background information that can be more properly or appropriately put in the main body of the report?
- b. *Introduction:*
- (1) Is background information sufficient?
 - (2) Are purposes of study clear and complete?
 - (3) Are scopes of study and report given?
 - (4) Should any of the material be removed and put in the Preface?
- c. *Main narrative:*
- (1) Is test equipment clearly described?
 - (2) Are test procedures clearly described?
 - (3) Are tests or investigations clearly described? Are they given in logical order? Are the purposes of each specific test given? Is each type of test tied in with the purpose of the overall investigation as stated in the Introduction?
 - (4) Are the test data clearly presented in best form? If given in more than one form, do the data agree? Are there too many detailed presentations of data, i.e. could some of the repetition be deleted or put in an appendix?
 - (5) Does the discussion or summary of results, or both, bring out the important findings of the tests? Do the results cover the purposes of the investigation?
 - (6) Are the conclusions really conclusions and not results?
 - (7) Are the recommendations relevant and reasonable based on the results of the study?
- d. *Illustrations.* Illustrations should be used only when needed to improve the report, because they are expensive. They should be used when necessary to clarify the text; they can sometimes be used instead of long descriptions or tabulations.
- (1) Are the Figures in the text kept to the minimum needed to illustrate certain points? Can any be made Photos or Plates in the interest of economy?
 - (2) Are the Tables properly arranged? Can any be combined, put in an appendix, put in text, or omitted? In editing Tables, use "Checklist" and "Suggestions" given in Chapter 16 of *Technical Editing* (Weil 1958).
 - (3) Are there too many Photos or not enough? Should any have labels to clarify them? How can they best be cropped to avoid large reductions or to emphasize important features? How can they best be arranged for comparison or economy?
 - (4) Are the Plates understandable? Are they uniform in lettering and wording? Can any be combined economically? Does each have a distinctive title?
- e. *Headings.* Go back over the report and check the headings to be sure that the format is correct, and that there are headings for each major section but not so many headings that the text is choppy. See that the headings are of appropriate weight for the material they cover. Can any be changed to make them more descriptive?
- f. *Summary.* Is the Summary an adequate boiling down of the report, i.e.

does it say why the study was made, how it was made, what was learned, and what was concluded? Does it mention all appendixes? In most reports, any recommendations included in the main text of the report should also be included in the Summary.

- g. *Report title.* Does title of report adequately cover the contents? Can it be shortened if long?
- h. *Abstract.* Is abstract as complete as possible within the usual limit of 250 words (approximately)?
- i. *Contents.* Does table of contents show all changes made in headings, Photos, Tables, Plates, etc.?

Functions of P&GAD Proofreaders

137. P&GAD provides proofreading services for copy prepared in P&GAD and also for copy prepared in the technical laboratories, if requested. A team consisting of a proofreader and a copyholder reads the copy to detect typographical errors and errors in style, grammar, spelling, and rhetoric. Proofreading is an important function, since it is almost impossible for the average worker to prepare copy without making errors. The editorial marks in general usage by P&GAD proofreaders and editors are as follows:

Markings in edited draft	Meaning of the mark
Since one notices that the data	Delete "one notices that"
The unclear test series	Transpose letters
had gone not far enough	Transpose words
stet	Restore deleted, crossed-out, or altered material
Director of the WES SP	Spell out
It was not found that	Insert at indicated point
The fall out contaminated	Close up space
in an isotropic medium	Space properly between characters
¶ The instruments showed that marked.	Make new paragraph
(The proof was read by	Run on. No new paragraph
The Holt Lock and dam	Upper case the "d"
The Holt P roject	Lower case the "P"
<input type="text"/> the tests were run	Move to left to point indicated
the tests were run <input type="text"/>	Move to right to point indicated
<input type="text"/> Purpose and Scope <input type="text"/>	Center horizontally on page
15 $\sqrt{20}$ 25	Move up to point indicated
15 $\sqrt{20}$ 25	Move down to point indicated
l.c.	Lower case
Cap. or "All caps"	Capital letters
c. & l.c.	Capitals and lower-case letters
#	Add space
^	Insert

PART VI: ERRORS OFTEN FOUND IN WES REPORT MANUSCRIPTS

138. Some of the grammatical and literary style errors often found in WES report manuscripts are discussed in the following paragraphs.

VOICE

139. The simpler, more direct, and more forceful active voice is preferred wherever possible. In their zeal to avoid first-person-singular construction, many WES writers eliminate all personal pronouns and even words for active agents, leading to the excessive use of the passive voice.

Weak:

Drainage of the area is accomplished by three streams.

Stronger:

Three streams drain the area.

Weak:

Telemetry of the data from the reservoir is done by a PAM-FM system.

Stronger:

A PAM-FM system telemeters data from the reservoir.

In addition to being the weaker form, passive voice often leads to ambiguity as to who or what is performing the action.

USE OF STRONG VERBS

140. Weak verbs (e.g. be, is, make) often lead to less economical sentence structure, as well as to a general weakness in expression. Notorious in poor technical writing is the conversion of a strong verb into a noun, which is then combined with a weak verb.

Poor:

Dose-rate measurements were made by the ion chambers to provide...

Better:

Dose rate was measured by the ion chambers to provide...

Still Better (active voice):

The ion chambers *measured* dose rate to provide...

NOMENCLATURE CONSISTENCY

141. Consistency in the use of technical terminology and abbreviations throughout a given report is essential. When an otherwise common word is used in a

particular context (such as "gust" for the dynamic pressure wave), it should be clearly defined the first time it appears. It must then be used the same way throughout the report.

142. The author should never assume that the reader has a full understanding of the terminology of a particular scientific field. Even if such is the case, the reader may have forgotten the meaning of a term when used in a special context.

PRECISION IN USE OF TERMS

143. Often WES writers are careless in the use of certain terms, such as in the use of the word "sample" when actually "specimen" is meant. Other examples include "mix" when "mixture" is intended, "bomb" or "weapon" when "device" is intended, "batch" when "round" is intended, etc.

USE OF RELATIVE PRONOUNS

144. Special care should be exercised in using such words as "this," "it," "which," etc., to avoid ambiguity. The author knows what is meant—but will the reader?

Vague:

The data recorded by the oscillograph from the radiometer were not significant, since it was inaccurate.

What was inaccurate: The radiometer? The oscillograph? The data?

145. Relative pronouns are handy devices to prevent objectionable repetition of the same words and phrases and should be used freely for this purpose, as long as care is taken in sentence construction to see that the reference is clear.

COLLECTIVE NOUNS

146. Whether a collective noun (e.g. group, number, majority, pair) takes a singular or plural verb depends upon its sense. When it refers to the whole group as a unit, the collective takes a singular verb. When it refers to the separate entities that make up the group, the collective takes a plural verb. (In case of doubt, the safest form to use is usually the singular.) The following examples represent good usage:

Ten grams of the isotope was collected.

A million dollars is a lot of money.

A number of specimens were placed in the fallout area.

The number of specimens used was increased to twelve.

Meaning or emphasis is the controlling factor. In the examples above, "grams" and "dollars," though plural in form, were considered to be singular collective nouns. In the third example, "number," though singular in form, required a plural verb for best agreement.

PERSON

147. WES reports should generally be written in the third person. The authors

may be referred to in the text, if necessary, as authors, project officers, experimenters, etc.

TENSE

148. Since WES reports are published after the test, the past tense should be used to describe what was done and what was found. Eternal truths, established physical laws, instructions, and conclusions should be written in the present or future tense. Care should be exercised to avoid confusing specific test information with eternal truths and established laws. The operation or design of a particular piece of instrumentation used during a specific test should not be considered as an eternal truth and, therefore, should generally be described in the past tense.

DANGLING MODIFIERS

149. A dangling modifier is a phrase or a clause that because of its position in a sentence appears to modify a word that it actually does not modify. The error is usually found in the use of participial phrases and gerunds:

By specifying standard resistors, the cost of the instrumentation can be reduced.

The cost of the instrumentation can be reduced by specifying standard resistors.

In both examples above, "specifying" wants to modify a noun or take a subject. The subject of the clause is the closest thing that could fulfill this requirement. But did "cost" specify the resistors? No. The three best ways of clearing up these examples are by (a) supplying a subject, (b) changing the verb form to a word that is obviously a noun and that therefore does not want to claim a subject, and (c) rewriting the sentence completely. The third method is usually the best.

Supplying subject:

By specifying standard resistors, *the designer* can reduce the cost of the instrumentation.

Changing verb to noun:

By *the specification of* standard resistors, the cost of the instrumentation can be reduced.

Rewriting:

The use of standardized resistors will reduce the cost of the instrumentation.

RESTRICTIVE AND NONRESTRICTIVE PHRASES AND CLAUSES

150. Close attention to the phraseology and punctuation of clauses is particularly important in technical writing. Often the editor will be unable to insure proper punctuation and clarity, so the author should be especially careful in preparing his manuscript. "That" is used to introduce restrictive clauses; "which" may legitimately

introduce either restrictive or nonrestrictive clauses, but confining its use to nonrestrictive clauses will help maintain clarity, and the editor will then be able to check the punctuation.

Restrictive:

The devices *that* were tested during Operation Redwing varied in yield. (Only *certain devices* were tested.)

Nonrestrictive:

The devices, *which* were tested during Operation Redwing, varied in yield. (*All the devices* were tested.)

Thus, clauses properly punctuated with commas take "which"; clauses without commas take "that."

151. However, the most important point to remember in regard to restrictive and nonrestrictive phrases and clauses is: *Set off by commas all nonrestrictive phrases or clauses.* "Nonrestrictive" implies a sentence element added only to amplify the meaning of or to add an afterthought to the main sentence thought. Conversely: *Do not set off with commas restrictive phrases or clauses.* "Restrictive" implies a sentence element that is essential to or limits the main sentence thought. The distinction between restrictive and nonrestrictive is often very important.

With commas:

The gamma radiation data, which were recorded to an accuracy of 10 percent, were used as a basis for...

This sentence means that all the gamma radiation data recorded were accurate to 10 percent—nonrestrictive.

Without commas:

The gamma radiation data which were recorded to an accuracy of 10 percent were used as a basis for...

This sentence means that only gamma radiation data actually accurate to 10 percent were used—restrictive. Thus, the presence or absence of the commas defines the meaning.

CORRECT USE OF NOTATIONS INVOLVING POWERS OF TEN

152. The notation " $\times 10^n$ " is common enough in scientific work and usually correctly used in text material. However, care must be taken in certain applications of this notation to tabular matter, in order to avoid ambiguity or misleading impression to the reader. A typical set of columnar entries might be as follows:

<u>Bending Moment</u>
in.-lb
36,500,000
6,400,000
22,000,000
321,000,000

In this example, the large numerical size of the data necessitates many zeros, and makes the information harder than necessary to read. Appropriate use of powers of ten would improve the column. One of the following notations might be used—two that are ambiguous and should be avoided, and two that are correct.

<i>Ambiguous:</i>	<i>Ambiguous:</i>	<i>Correct:</i>	<i>Correct:</i>
<u>Bending Moment</u>	<u>Bending Moment</u>	<u>Bending Moment</u>	<u>Bending Moment</u>
in.-lb $\times 10^6$	in.-lb $\times 10^{-6}$	10^6 in.-lb	in.-lb
36.5	36.5	36.5	3.65×10^7
6.40	6.40	6.40	6.40×10^6
22.0	22.0	22.0	2.20×10^7
1.43	1.43	1.43	1.43×10^6
321	321	321	3.21×10^8

In the first ambiguous example, the notation for the unit of measure reads, literally: "inch-pounds multiplied by one million"; does this mean that the value 36.5, for instance, has already been multiplied by one million? Or, should it be multiplied by one million? (Is the true value 0.0000365 or 36,500,000?) In the second example, the same kind of ambiguity results. In the third example, the notation for the unit of measure reads literally "millions of inch-pounds"; this means that the first value, for instance, is 36.5 "millions of inch-pounds," which is correct. This form of the notation is most applicable when it is desired to point up a comparison of the values in the columns. The fourth example also shows good use of the " $\times 10^n$ " notation, but should be used only when it is desired to emphasize the accuracy to which the instrument used could be read; i.e., it indicates that an instrument was used which could be read to hundredths and which had scale settings that read in millions, tens of millions, and hundreds of millions. The notation used in the third example is preferred from the standpoint of ease of composition and clean appearance of the table; the fourth example is applicable in the special case where emphasis of the instrument accuracy is the more important consideration.

USE OF TEXT TO AMPLIFY, DISCUSS, AND EXPLAIN TABLES AND GRAPHS

153. The technical report text should be used to amplify, discuss, and explain Tables and graphs, not just to repeat what appears therein. The function of a Table or graph is to condense and thereby efficiently present a quantity of data. Therefore, repeating such data in the text is unnecessary. Rather, the text should be the writer's medium for explaining the significance of the tabular or graphical data, calling the reader's attention to special facts, making important comparisons, etc. From this, it is obvious that each Table or Plate must be referenced in the text—if a Table or Plate cannot be so referenced, it does not belong in the report. Similarly, it is usually unnecessarily redundant to repeat the same data in both a Table and a Figure. An

exception to this might be when a smooth curve appears on a graph, but where the actual data values need to be available to the reader and are so complex as to make showing them on the graph physically difficult. In this case, the smooth curve and a Table of the values might be appropriate. The order of reference to a series of Tables or Plates should generally be in numerical sequence throughout a report, for utmost utility to the reader.

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APPENDIX A: WORD LIST

1. The word list below comprises difficult or uncommon words often used in WES reports. Experience has shown that these words are often troublesome because of the confusion regarding whether they are one-word or two-word forms, hyphenated or unhyphenated, etc. Much time and money will be saved if WES *authors* and *draftsmen* will refer to this list when *preparing illustrations*.

aboveground (adj)	bottom lift (n)
above ground (adv)	bottom-lift (adj)
above-mentioned	Bouyoucos gage
aforementioned	breakaway
aforesaid	breakpoint
airblast	broadleaf
airborne	buildup (n)
airburst	build up (v)
air-dry (v, adj)	built-up (adj)
airflow	bypass
airmobile (adj)	by-product
air photo	
alignment (WES)	cap rock
alinement (DNA)	capstone
alongshore	Cartesian
armor stone	centerline (n, adj) (DNA)
artwork	center line (n) (WES)
asphaltic concrete pavement	center-line (adj) (WES)
	channel side (n)
back draft	channel-side (adj)
backfill	checkpoint
back slope	cleanup (n, adj)
back up (v)	clean up (v)
backup (n, adj)	close-up (n)
bandwidth	closeup (adj)
bank-full	close up (v)
bank line	coastline
bank side (n)	coldwater (adj)
bank-side (adj)	continental shelf
baseline	Corps-wide
baseplate	court-martial (n, v)
beachhead	cover layer (n)
beachline	cover-layer (adj)
beach side (n)	cover plate
beach-side (adj)	crossarm
bed form	cross-bedded
bed load (n)	cross-bedding
bed-load (adj)	crosscurrent
bedrock	crossflow
bell-mouthed	cross over (v)
benchmark	crossover (n, adj)
birdbath	crossroad
borderline (adj)	cross section (n)
border line (n)	cross-section (v, adj)
borehole	cross-sectional (adj)
bottleneck	cross wave
bottomland	cutback (n, adj)

cut back (v)	free flow (n)
cutoff (n, adj)	free-flow (adj)
cut off (v)	fresh water (n)
	freshwater (adj)
damsite	front line (n)
Darcy's law	frontline (adj)
dead load	frost-free
dead water (n)	further (extent)
dead-water (adj)	fuseplug
deadweight	
de-air	gage
deep water (n)	geosim (geometrically similar)
deepwater (adj)	go-no go
disc (computer)	gradeability
discretize	grade line
downdrift	groundline
downpull	groundwater (n, adj)
drawdown (n)	grumusol
draw down (v)	guard wall
dump truck	guideline
dust-free (adj)	guide wall
earth fill (n)	half-space (n, adj)
earth-fill (adj)	handlaid
ebb flow	handline
enclosure*	harbor side (n)
endorsement*	harbor-side (adj)
end point	hard points
end sill	headbay
exceedance	headbox
extremize	head loss
	headroom
far field	headwater
farmland	high velocity (n)
farther (distance)	high-velocity (adj)
fiberglass (n, adj)	high water (n)
fieldwork	high-water (adj)
flap gate	hometown (n, adj)
flatland	hot plate
flood-control (adj)	hydraulic-jump type basin
flood flow	
floodgate	ice cap
floodplain	ice-free
flood stage	
floodwall	jobsite
floodwater	
flowchart	LaGuardia
flow line	lake bed
flowmeter	lakeshore
fly ash	landfill (n, adj)
forklift	landform
FORTTRAN	landlocked
free body (n)	landside
free-body (adj)	land wall
free-fall	

* Use "inclosure" and "indorsement" when referring to correspondence.

lightweight (adj)
Lixator
lock wall
longtime (adj)
low water (n)
low-water (adj)

main-line (adj)
main stem
mainstream
man-hour
man-made
Manning's n
Mercator
midbank
midchannel
middepth
midheight
mid-latitude
midpoint
midspan
mudflows
mud-free (adj)

nearshore
no-go

oceangoing
ocean side (n)
ocean-side (adj)
off-road
offshore
ongoing
onshore
onsite
oven-dry (v)
ovendry (adj)
overall
overbank
overpressure
overrun
overwater (adj)

payload
percent
Petersen dredge
pipeline
Plexiglas
point bar (n, adj)
Pontacyl Brilliant Pink
powerhouse
power plant
Precambrian
print out (v)
printout (n, adj)
programmed

programmer
programming
pug mill
pulldown (n, adj)
pull down (v)
pumpback
pump house
pushbar
Pyrex

quarry-run stone
quarrystone
quarter point

rainwater
Ramm
range 5
rattail
reentrants
reevaluation
reuse
Reynolds number
ridge crest
ridgetop
riverbank
riverbed
river bend
riverflow
riverside
river wall
roadbed
rockbound (adj)
rockfall (n)
rock fill (n)
rock-fill (adj)
rollout
rubble-mound (adj)
rundown (n)
run-down (adj)
run down (v)
runoff
run-on
runout
runup (n)
run up (v)

saltwater (adj)
salt water (n)
sandbar
sand bed
sand trap
seabed
seacoast
seagoing
sea side (n)

sea-side (adj)
 seawall
 seawater
 setup (n)
 set up (v)
 shallow water (n)
 shallow-water (adj)
 sheet metal
 shoreline
 short-time (adj)
 shutoff
 sidecast dredge
 side slope
 sidewall
 signal-conditioning
 sinkhole
 skin plate
 slack water (n)
 slack-water (adj)
 slip form (n)
 slipform (v, adj)
 slipformed (v, adj)
 slipforming (v, adj)
 slowdown
 snow cover
 snowfall
 snowmelt
 standby
 standoff (n, adj)
 state-of-the-art (adj)
 state of the art (n)
 steerageway
 still water (n)
 still-water (adj)
 stop log
 streambank
 streambed
 streamflow
 streamline
 Styrofoam
 Surfa-aero-sealz
 surf beat

tack weld (n)
 tack-weld (v)
 tailbay
 tailgate
 tailpipe
 tailwater
 takeoff (n)
 take off (v)
 tar-rubber
 taxilane
 template
 Tenite butyrate
 Terra-tire

Thiokol
 tidewater
 tie-back levee
 tie-down
 time-consuming
 timetable
 topdressing
 top lift (n)
 top-lift (adj)
 topside
 topsoil
 top stratum
 trade-off (n, adj)
 trapdoor
 trashrack
 Tri-Cone
 turndown (adj)

underlayer
 underside
 underwater (n, adj, adv)
 upriver
 Uranine

venturi
 Vermilion Bay
 von Karman
 von Mises

waist-deep
 warm water (n)
 warmwater (adj)
 wastewater (n, adj)
 waterborne
 watercourse (hydraulics)
 water-course (concrete)
 waterline
 water stop
 water table (n, adj)
 watertight
 wave form
 wave front
 wavelength
 weighhouse
 well flow
 wellpoint
 wind field
 wing wall
 workboat
 work load
 worldwide
 worthwhile
 wraparound

X-ray (n, adj, v)

APPENDIX B: ABBREVIATIONS GUIDE FOR WES REPORTS

1. The following is a list of abbreviations commonly used at WES. Though by no means complete, it does include most unit-of-measure abbreviations and other closely related abbreviations acceptable for use in WES reports. For additional abbreviations refer to the *American Standard Abbreviations for Scientific and Engineering Terms*, the *GPO Style Manual*, and Webster's Unabridged.

Term	Abbreviation
acre	spell out
acre-foot	acre-ft
alternating current	a-c (as adj); AC (as noun)
ampere*	amp
ampere-hour	amp-hr
Angstrom unit	Å
antilogarithm	antilog
approximate	approx
atmosphere	atm
average	avg
bar	spell out
barrel	bbl
Baumé	Bé
biochemical (or biological) oxygen demand	BOD
brake horsepower	bhp
British thermal unit	Btu
California Bearing Ratio	CBR
calorie	cal
center line	CL
center to center	c-c, c to c
centigram	cg
centilitre	cl
centimetre	cm
centimetre-gram-second (system)	cgs
centimetres per second	cm/sec
centipoise	cp
chemical oxygen demand	COD
cologarithm	colog
cosecant	csc
cosine	cos
cotangent	cot
cubic	cu
cubic centimetre	cu cm, cc, cm ³
cubic feet	cu ft, ft ³
cubic feet per minute	cfm, cu ft/min, ft ³ /min
cubic feet per second	cfs, cu ft/sec, ft ³ /sec
cubic inch	cu in., in. ³
cubic metre	cu m, m ³

Note: The word "per" can be substituted for the diagonal (/). But in any one report, be consistent.

* For a report written using metric (SI) units, the abbreviations for ampere, volt, and watt are A, V, and W, respectively. (Kilovolts would be abbreviated kV, milliampere, mA, etc.)

Term	Abbreviation
cubic micron	cu μ , μ^3
cubic millimetre	cu mm, mm ³
cubic yard	cu yd, yd ³
cycles per minute	cpm
cycles per second	cps
day	spell out
decibel	db
decibels referred to one milliwatt	dbm
degree*	deg or °
degree Centigrade (or Celsius)	°C
degree Fahrenheit	°F
degree Rankine	°Ra
degree Réaumur	°R
degrees per second	deg/sec
diameter	diam
direct current	d-c (as adj); DC (as noun)
dissolved oxygen	D.O.
downstream	D.S.
dozen	doz
electromotive force	emf
elevation	el
equation	spell out generally (use "Eq" in tables or drawings where space is a factor)
feet per minute	fpm, ft/min
feet per second	fps, ft/sec
feet per second per second	ft/sec ²
foot	ft
foot-pound	ft-lb
foot-pound-second (system)	fps
gallon	gal
gallons per day	gpd, gal/day
gallons per minute	gpm, gal/min
gallons per second	gps, gal/sec
gram	g
gravity (units)	g's
Greenwich time	GW
ground zero	GZ
hectare	ha
hertz	Hz
high explosive	HE
high-water interval	HWI
horsepower	hp
horsepower-hour	hp-hr
hour	hr
hundredweight (112 lb)	cwt
hyperbolic cosecant	csch
hyperbolic cosine	cosh

* Use "degree" symbol in tabulations, where space is an important factor, or in a situation where an abbreviation would be awkward, i.e. 40°14'12".

Term	Abbreviation
hyperbolic cotangent	coth
hyperbolic sine	sinh
hyperbolic tangent	tanh
inch	in.
inches per second	ips, in./sec
inch-pound	in.-lb
inside diameter	ID
joule	J
Kelvin	K
kilobar	kbar
kilocalorie	kcal
kilocycle	kc
kilocycles per second	kcps
kilogram	kg
kilogram-calorie	kg-cal
kilogram-metre	kg-m
kilograms per cubic metre	kg/cu m, kg/m ³
kilograms per second	kgps, kg/sec
kilohertz	kHz
kilolitre	kl
kilometre	km
kilometres per second	kmps
kilonewton	kN
kilopound (1000-lb deadweight load)	kip
kiloton	kt
kilovolt*	kv
kilovolt-ampere*	kva
kilowatt*	kw
kilowatt-hour*	kwhr
kips per square inch	ksi
knot	spell out
linear	lin
litre	l (usually a script <i>ℓ</i>)
logarithm (common)	log
logarithm (natural)	ln, log _e
magnified 50 times	×50
Manning's roughness	n
maximum	max
mean higher high water	mhhw
mean lower low water	mlw
mean low tide	mlt
mean sea level	msl
megahertz	MHz
megapascal	MPa
megaton	Mt
metre	m
metre-kilogram	m-kg
mho	spell out
microampere*	μa
microinch	μ in., micron

* For a report written using metric (SI) units, the abbreviations for ampere, volt, and watt are A, V, and W, respectively. (Kilovolts would be abbreviated kV, milliampere, mA, etc.)

Term	Abbreviation
micron	μ
microsecond	μ sec
microvolt*	μ v
microwatt*	μ w
mile	spell out
miles per hour	mph
milliampere*	ma
millibar	mb
milligram	mg
millilitre	ml
millimetre	mm
millimicron	m μ
million electron volts	Mev
million gallons per day	mgd
millisecond	msec
millivolt*	mv
minimum	min
minute	min
minute (angular)	'
month	spell out
nanosecond	nsec
newton	N
nuclear explosive	NE
number(s)	No.
ohm	Ω
ohm-centimetre	ohm-cm
ounce	oz
ounce-foot	oz-ft
ounce-inch	oz-in.
outside diameter	OD
parts per million	ppm
parts per thousand	ppt
pascal	Pa
percent (tabular)	spell out or %
pint	pt
pores per linear inch	ppi
pound	lb
pound-foot	lb-ft
pound-inch	lb-in.
pounds per cubic foot	pcf, lb/cu ft, lb/ft ³
pounds per square foot	psf, lb/sq ft, lb/ft ²
pounds per square inch	psi, lb/sq in., lb/in. ²
pounds per square inch absolute	psia
pounds per square inch differential	psid
pounds per square inch gage	psig
quart	qt
radian	rad
revolutions per minute	rpm
revolutions per second	rps

* For a report written using metric (SI) units, the abbreviations for ampere, volt, and watt are A, V, and W, respectively. (Kilovolts would be abbreviated kV, milliampere, mA, etc.)

Term	Abbreviation
Reynolds number	R
rod	spell out
roentgen	spell out
secant	sec
second	sec
second (angular)	"
sine	sin
specific gravity	sp gr
square centimetre	sq cm, cm ²
square foot	sq ft, ft ²
square inch	sq in., in. ²
square kilometre	sq km, km ²
square metre	sq m, m ²
square micron	sq μ , μ^2
square mile	spell out
square millimetre	sq mm, mm ²
station	sta
still-water level	swl
tangent	tan
thousand pounds	kip
ton	spell out
tons per square foot	tons/sq ft, tons/ft ² , tsf
total Kjeldahl nitrogen	TKN
upstream	U.S.
volt*	v.
volt-ampere	va
watt*	w
watt-hour	whr
week	spell out
yard	yd
year	spell out

* For a report written using metric (SI) units, the abbreviations for ampere, volt, and watt are A, V, and W, respectively. (Kilovolts would be abbreviated kV, milliampere, mA, etc.)

APPENDIX C: GREEK ALPHABET, AND MATHEMATICAL SYMBOLS AND EXPRESSIONS

GREEK ALPHABET

1. Greek letters available on P&GAD typewriters are as follows:

Letters		Names	Letters		Names	Letters		Names
A	α	Alpha	I	ι	Iota	P	ρ	Rho
B	β	Beta	K	κ	Kappa	Σ	σ	Sigma
Γ	γ	Gamma	Λ	λ	Lambda	T	τ	Tau
Δ	δ	Delta	M	μ	Mu	Υ	υ	Upsilon
E	ϵ	Epsilon	N	ν	Nu	Φ	ϕ	Phi
Z	ζ	Zeta	Ξ	ξ	Xi	X	χ	Chi
H	η	Eta	O	\omicron	Omicron	Ψ	ψ	Psi
Θ	θ	Theta	Π	π	Pi	Ω	ω	Omega

MATHEMATICAL SYMBOLS AND EXPRESSIONS

2. The following list provides the most common conventions used in mathematics:

+	plus	\ll	much less than
-	minus	\propto	varies as
\pm	plus or minus	:	is to, ratio
\times	multiplied by	\rightarrow	approaches limit of
\div	divided by	$\ $	absolute value
=	equal to	$\sqrt{\quad}$	radical; root; square root
\neq	not equal to	$\sqrt[3]{\quad}$	cube root
\approx	approximately equal to	Δ	difference; increment
\equiv	identical with	d	differential
\ncong	not identical with	∂	partial differential
\sim	similar to	∇	del or nabla; vector differential operator
\cong	congruent to	!	factorial
$>$	greater than	\bar{x}	mean of x
$<$	less than	Σ	summation
\geq	greater than or equal to	\int	integral
\leq	less than or equal to	$f(\quad)$	function of
\gg	much greater than	∞	infinity

i	imaginary unit; the square root of -1	L	right angle
()	parentheses	Δ	triangle
[]	brackets	□	square
{ }	braces	▭	rectangle
∴	therefore	▭	parallelogram
∥	parallel	○	circle
⊥	perpendicular	⌢	arc of circle between points A and B
∠	angle		

3. WES style* for presentation of equations and other mathematical expressions is summarized as follows:

- Use the sequence $\{ [()] \}$ for signs of aggregation, except where conventional notation specifies brackets or braces.
- Make aggregation, integral, and summation signs the same height as the expressions which they include, or slightly larger.
- Place subscripts and superscripts, respectively, half a line below and above the lowest and highest characters in the related material.

Examples: R_1 , $\left(2 \frac{N \Delta_1}{Eh} \right)^{1/2}$

- Align subscripts with superscripts.

Examples: p_n^2 , $F_{\epsilon}^{(p,q)}$, p_n^{-2}

- Place sub-subscripts half a line below the subscripts.

Example: E_{x_o}

- Use lowercase o's for both subscript and superscript zeros, except in juxtaposition to other superscript or subscript numbers.

Examples: K_o^2 , $f_2(t_o) = f_2(t_1)$, $n^{0.15}$

- Raise th to a superscript position.

Examples: n^{th} , i^{th}

* A Style Manual for Technical Writers and Editors, by S. J. Reisman, was used extensively in adopting WES style of presentation of mathematical material.

- h. In equations, leave 1 space before and after the operational signs $+$, $-$, \pm , \times , \div , and \cdot .

Exception: leave no space before and after such signs in subscripts and superscripts.

Examples: $a + b$, ...if $a + b = 10$ and the...

$$na^{n-1}, \quad \sum_{x=0}$$

- i. Leave no space after $+$, $-$, and \pm when these indicate the sign of a single term in the text or a single term enclosed in parentheses or brackets in an equation.

Examples: ...within ± 4 cm... , $P(x) = -\phi_0(-x) + R$

...at an elevation of $+10$ msl...

- j. Leave 1 space before and after $=$, $<$, $>$, \leq , and \geq in displayed and in-text equations.

Exception: Leave no space before and after these signs in subscripts and superscripts.

Examples: ...when $2xy > b$ we find...

(In-text equation)

$$\sum_{k \leq 0}^{\infty} a_k (z - a)^k = z_a$$

(Displayed equation)

- k. Leave no space before and after a group of three dots indicating an omission; leave no space between the dots; and type the dots on the line as if they were periods.

Example: $a = n + 1...+5$

- l. Align the bar of a built-up fraction with the center of the equals sign. Center the numerator and denominator relative to the horizontal bar in a built-up fraction.

Example: $a = \frac{-K'_a + \sqrt{(K'_2)^2 + 4K'_2 C}}{2C}$

- m. Type any required bar or dot immediately above the mathematical symbol, so that it will be obvious that the bar or dot and the symbol constitute a unit. The bar is made by rolling up the underscore. (For the lowercase i , it is necessary to raise the bar or dot a little more.)

Examples: \bar{K} , \bar{k} , \dot{i} , \dot{r}

- n. Leave no space between the single-line elements of a product, and leave no space before and

after punctuation within such material. Leave 1 space between double-line (built-up) elements of a product.

Examples: $2xy$, $2C$, $I(M_o, N)$

$$I_o^2(A_o^2, N) \quad , \quad \frac{1}{2n} \frac{(j+m)}{(j-m)}$$

o. Leave 1 space before and after trigonometric, logarithmic, or exponential functions, and between the parts of such functions.

Examples: $v \cos \theta$, $Y \ln x$, $2 \log y \log z$,

$$\frac{1}{2} \exp \left(a + \frac{h}{2} \right)$$

p. Leave 1 space before and after differentials and between differentials.

Examples: $x \, dx$, $(x^2 + y^2) \, dx \, dy$

q. Use signs of aggregation large enough to enclose the material within. Center signs of aggregation relative to the equals sign. Leave no space between adjacent signs of aggregation.

Exception: When the material contains only simple superscripts or simple subscripts (but not both), use the standard-size typewriter keys for the signs.

Example: $(K^2 + A)$, $(K^2 + A_1 + K_2 + B^2)$

$$A - \left\{ (x_a + x_b)^2 + [1 - \sin^2 \Delta \cos (\theta - \Delta)] \right\}$$

$$x = \begin{bmatrix} \xi_1 \\ \xi_2 \\ \dots \\ \xi_n \end{bmatrix} = \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1n} \\ t_{21} & t_{22} & \dots & t_{2n} \\ \dots & \dots & \dots & \dots \\ t_{n1} & t_{n2} & \dots & t_{nn} \end{bmatrix} \begin{bmatrix} \bar{\xi}_1 \\ \bar{\xi}_2 \\ \dots \\ \bar{\xi}_n \end{bmatrix} = T \bar{x}$$

r. Use an integral sign large enough so that it is not overshadowed by the material on either side.

Examples: $\sqrt{\frac{a}{b}} \int_0^{h+1} \frac{dx}{\sqrt{hx - x^2}} \left(1 - \frac{x}{2a}\right)^{1/2}$

$$\sin^{-1} x = \int_{0+1}^x \frac{dz}{\sqrt{1 - z^2}}$$

- s. Center material above and below a summation sign.

Example: $\sum_{-\infty}^0$

- t. Make parallel lines long enough to extend to the top and bottom of the material between them.

Example: $\left| E_{x_0}^2 \right|$

- u. The following rules apply only to the spacing of in-text mathematical material.

- (1) Leave 2 spaces before and after a mathematical symbol or equation; leave 1 space between such a symbol or expression and a punctuation mark which follows.

Examples: ...corresponding to \bar{k}^T which equals...
 ...the term, \bar{k}^T . Then the...
 ...the case $c = (10 - t + T)$ estimates...

- (2) If an in-text equation must be broken, break it before the equals sign or operational sign.

- (3) When a mathematical expression is followed by a unit of measurement, leave 1 space between the mathematical expression and the unit and leave 2 spaces between the unit and subsequent text. Leave no space between unit of measure and punctuation.

Examples: ...the interval of $\sigma t = 0.04$ sec used in the...
 ...if $\sigma t = 0.04$ sec, then...

- v. Displayed equations are always displayed with special indentation and layout (see Figures C1-C5). When breaking displayed equations, break before equals or operational sign.

$$\vec{A}(q') = \int_S G(q', p) \vec{J}(p) \, dS - \frac{1}{k^2} \int_S \Delta' \Delta G(q', p) \cdot \vec{J}(p) \, dS \quad (1)$$

$$\vec{A}_2(q') = \int_S \Delta' \Delta G(q', p) \cdot \vec{J}(p) \, dS \quad (2)$$

Figure C1. Display of single-line equations

$$y = c_1 e^{ax} \cos ax + c_2 e^{ax} \sin ax + c_3 e^{-ax} \cos ax \\ + c_4 e^{-ax} \sin ax + c_5 e^{-ax} \cos ax + c_6 e^{-ax} \sin ax$$

$$(\mu + \nu \tan \mu \cot \nu) \nu = -T(mr)^{-1} \cos \mu \cos \theta \sin \epsilon$$

$$- \frac{P}{2} S V^2 C_L (mr)^{-1} \sin \phi \cos \mu$$

$$- \frac{3g_o R^2}{2r^2} K_\Delta \sin 2\mu \sin 2 \sin 2\nu$$

$$\phi = \omega_x + \epsilon \sin \Delta - \omega_{x_0} \cos \Delta \cos \epsilon - \omega_{y_0} \cos \Delta \sin \epsilon + \omega_{z_0} \sin \Delta$$

$$= \omega_x + \tan \Delta (\omega_4 \sin \phi + \omega_z \cos \phi) - \omega_{x_0} \cos \Delta \cos \epsilon$$

$$- \omega_{y_0} \cos \Delta \sin \epsilon + \omega_{z_0} \sin \Delta$$

Figure C2. Display of stacked right-hand members

$$\int_{-1}^1 P_m(x) \frac{d}{dx} [(1-x^2)P'_n(x)] dx - \int_{-1}^1 P'_n(x) \frac{d}{dx} [(1-x^2)P'_m(x)] dx$$

$$+ (n-m)(n+m+1) \int_{-1}^1 P_m(x)P_n(x) dx = 0$$

$$(z - z_1)^r \frac{d^r w}{dz^r} + (z - z_1)^r p_1(z) \frac{d^{r-1} w}{dz^{r-1}}$$

$$+ (z - z_1)^{r-2} p_2(z) \frac{d^{r-2} w}{dz^{r-2}} + \dots + p_r(z) w = 0$$

$$\sum_n \left\{ \left[\Delta_n^2 \Delta_n^2 f_n + \frac{ik^2}{a} \cdot \frac{1}{2} \left(\frac{1}{a} + \frac{1}{b} \right) \Delta_n^2 f_n \right] \cos n\theta \right.$$

$$+ \frac{ik^2}{a} \cdot \frac{1}{4} \left(\frac{1}{b} - \frac{1}{a} \right) \left[\left(\frac{d^2 f_n}{dr^2} - \frac{(2n+1)}{r} \frac{df_n}{dr} + \frac{n(n+2)}{r^2} f_n \right) \cos (n+2)\theta \right.$$

$$\left. \left. + \left(\frac{d^2 f_n}{dr^2} + \frac{(2n+1)}{r} \frac{df_n}{dr} + \frac{n(n-2)}{r^2} f_n \right) \cos (n-2)\theta \right] \right\} = 0$$

Figure C3. Display of stacked left-hand members

$$\begin{aligned}
& \frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{\exp(-itw_1)}{2\sigma_{11}\sigma_{12} \sin \theta_{12}} \\
& \quad \frac{dt}{\left\{ \left[\frac{1}{4} \left(\frac{1}{\sigma_{11}^2 \sin^2 \theta_{12}} - \frac{1}{\sigma_{12}^2} \right) \right]^2 + \left[\frac{1}{4} \left(\frac{1}{\sigma_{11}^2 \sin^2 \theta_{12}} + \frac{1}{\sigma_{12}^2} \right) - it \right]^2 \right\}^{1/2}} \\
& = \frac{1}{2\pi} \int_{-\infty}^{\infty} \exp(-itw_1) \left\{ \frac{1}{2\sigma_{11}\sigma_{12} \sin \theta_{12}} \int_0^{\infty} \exp \left[-\frac{1}{4} \left(\frac{1}{\sigma_{11}^2 \sin^2 \theta_{12}} + \frac{1}{\sigma_{12}^2} \right) s \right] \right. \\
& \quad \left. J_0 \left[\frac{1}{4} \left(\frac{1}{\sigma_{11}^2 \sin^2 \theta_{12}} - \frac{1}{\sigma_{12}^2} \right) s \right] e^{ist} ds \right\} dt \\
& \frac{(-)^n}{n!} y^{2n} \left[(2 + 3 + 4 \dots + n) + 2(3 + 4 \dots + n) \dots \right. \\
& \quad \left. + i(i + 1 + \dots + n) \dots + (n - 1)n \right] \\
& = \frac{(-)^n}{n!} y^{2n} \left[\frac{(n-1)(n+2)}{2} + \frac{2(n-2)(n+3)}{2} \dots + i \frac{(n-i)(n+i+1)}{2} \dots \right] \\
& = \frac{(-)^n}{n!} y^{2n} \sum_{i=1}^n \left[(n^2 + n)i - i^2 - i^3 \right]
\end{aligned}$$

Figure C4. Display of stacked right-hand and left-hand members

$$\begin{aligned}
& I_x \omega_x + h_x + \omega_y \omega_x (I_z - I_y) + \omega_y h_z - \omega_z h_y \\
& = + \frac{3g_o R^2}{r^3} \left(I_x \sin^2 \theta - I_y + I_z \cos^2 \theta \right) \phi \cos \theta + \frac{P}{2} u^2 S l_{xy} C_y + m_x \\
\\
& -\Delta^2 \int_{\Delta u_i} \frac{1}{3 \Sigma_a \xi \Sigma_s} q(\vec{r}) du + \int_{\Delta u_i} \frac{\Sigma_a}{\xi \Sigma_s} q(\vec{r}) du \\
& = -q(\vec{r}, u_i) + q(r, u_{i-i}) + P(\vec{r}) \int_{\Delta u_i} X du + \int_{\Delta u_i} Q(\vec{r}) du
\end{aligned}$$

Figure C5. Display of equations with both members more than half a line, but less than a full line

APPENDIX D: COPY PREPARATION

PART I: INTRODUCTION

1. This appendix is intended for use by typing personnel in the laboratories preparing drafts of WES technical reports as well as by P&GAD personnel preparing camera-ready copy of these same reports for subsequent printing.

2. Observance of the basic rules of report copy preparation set forth herein will avoid needless changes and will reduce the cost of copy preparation as the report proceeds from the first draft to the final reproduction copy.

3. P&GAD and most of the laboratories have some type of word processing equipment. Detailed instruction in the use of this equipment is beyond the scope of this appendix, but P&GAD offers as a service to the laboratories instructions in the proper use and coding of word processing equipment so that maximum efficiency is achieved. Arrangements can be made for this instruction with P&GAD, Reports Branch.

4. The mechanics of format, titles, headings, and tables are discussed in the following paragraphs and illustrated in Figures D1-D9. Of necessity, some of the information is a repetition of that presented previously in the main text. By no means has this appendix covered completely the subject of copy preparation. P&GAD has collected many examples of copy preparation problems and solutions, and the services of P&GAD personnel are available to the laboratories to give guidance and suggestions for the solution of your copy preparation problems.

PART II: THE FORMAT

TYPED-AREA DIMENSIONS

5. The typed area of a page of a WES report should not be more than 6 in. wide by about 9 in. long (Figure D1). A 6-in.-wide typewritten line consists of 72 spaces (elite type). The lines should be of approximately the same length, but words should not be divided contrary to correct syllabication as given in the dictionary to achieve this evenness. The 9-in. length includes 34 lines of text (line spacing, 1-1/2) and the page number. The 34 lines will actually occupy 8.4 in. It is sometimes difficult to maintain the 8.4-in. length if single-spaced matter such as subparagraphs or footnotes appear on the page and are of uneven length. However, the spacing above and below headings (see paragraphs 19-21) is sufficiently variable so that the spacing can be adjusted to produce the desired length.

MARGINS

6. WES publications are printed on paper 8 in. wide by 10-1/2 in. long. With the typed-area dimensions described above, the margins will be about 1 in. at the top, 1 in. on both sides, and 0.7 in. at the bottom. To accomplish this the first line of type is six typewritten spaces down from the top of the page. The page number is typed three spaces from the 34th line of type in the center of the 6-in. width.

PARAGRAPHS

7. As stated previously in the main text, paragraphs of WES reports are numbered. The purpose of numbering paragraphs is for ease of reference, which is considered of sufficient importance to outweigh other undesirable features of this practice.

8. Paragraphs are indented six spaces; i.e., six spaces to the paragraph number. Subparagraphs are typed single space and are indented the same number of spaces as the first word of the main paragraph. The subparagraph should be typed in block style and should extend to the right margin of the page. See examples in Figure D2.

First line of type of text or title or margin of illustration.

line 1

6" 9"

Maximum extent of typescript or illustration.

line 34

Page Number

Figure D1. Recommended average dimensions for text page (not to scale)

PART V: CONCLUSIONS AND RECOMMENDATIONS

← 3 Spaces

Conclusions

← 3 Spaces

153. The conclusions drawn from the analysis of data in this report are as follows:

- a. The model of a new overland flow system was effective for advanced treatment of secondary effluent with mass removal of 92 percent for nitrogen; 75 percent for phosphorus; 100 percent for cadmium, copper, manganese, and nickel; 91 percent for lead; and 72 percent for zinc.
- b. The grass harvest was effective for removal of 31 percent of the applied nitrogen, but smaller amounts of phosphorus and heavy metals, generally less than 10 percent of that applied, were removed in the grass.
- c. The elements retained in the model were fixed or volatilized since they were not readily extracted or exchanged with neutral ammonium acetate solution.
- d. Conditions for gaseous loss of nitrogen through denitrification existed at the surface of the model as evidenced by oxidation-reduction potential measurements.
- e. The nitrogen load of the model can be increased since only half of the length was used for nitrogen removal, provided that the minimum fertilization requirements of the grass are satisfied.
- f. Increased nitrogen supply and grass growth would probably improve treatment effectiveness for other elements.
- g. The removal of only 75 percent of the applied phosphorus indicates a need for more surface contact, either by surface roughness of soil or by increased model length.
- h. The subflow showed excellent removal of nitrogen, phosphorus, and heavy metals indicating effective removal mechanisms by the soil during the study period.

← 3 ½ Spaces

Recommendations

(Adjust for single spaced material in order to be on proper line)

← 3 Spaces

154. Based on the literature and results of this study, interim recommendations for guidance in the design and operation of overland flow treatment systems for wastewater from military reservation treatment plants are given as follows:

Figure D2. Example of indentions and single-spaced subparagraphs

PART III: TITLES AND HEADINGS

9. For WES reports, the word "title" denotes the main title of the report and the titles of major parts of the report; subtitles used within major parts are designated "headings."

TITLES

Main Report Title

10. The title of a report should appear on the first page of the main body of the report (*not* on the Preface or Contents pages), should begin on line 1, should be centered between the margins, and typed in underlined capitals (see Figure D3). If the title requires more than one line, there should be one blank space between each of the lines. For the titles of more than one line, the inverted pyramid style (each line centered and shorter than the line above it) should be used. Dividing words and separating closely related terms or groups of words should be avoided whenever possible without marring the typographical appearance.

11. The wording of the title of the report as it appears on the first page of text should be *exactly* the same as the title on the cover of the report. Titles are considered display type, and as such should have no punctuation at the ends of the lines.

12. For reports of model studies the title may include a line of secondary importance stating that it is a model investigation (Figure D3). Other reports may also include qualifying phrases such as "Interim Report" or "Preliminary Report." This line of secondary importance will be underlined but will be typed in lower case with initial capitals, as:

<u>NAVIGATION CONDITIONS AT CANNELTON</u>	{ main title, inverted pyramid style
<u>LOCKS AND DAM, OHIO RIVER</u>	
<u>Hydraulic Model Investigation</u>	{ line of secondary importance

13. For reports constituting one of a series, with the same comprehensive title for each report but with a different specific title for each, the arrangement should be:

<u>SOIL COMPACTION INVESTIGATION</u>	{ comprehensive title { specific title
CLAYEY SAND TEST FILLS	

14. As stated previously the title of the report should begin on line 1. The last line of the title should be separated from the material below it (usually the title of Part I) by 3, 4-1/2, or 6 spaces, whichever affords the best arrangement of the text material on that page, or in the remainder of that part of the report (Figure D3). Care should be taken to keep the length of the text material on that page, from the top of the first line of the title to the bottom of the last line of text (or footnote(s)), to about 8.4 in.

Note:→

GRAYS HARBOR ESTUARY, WASHINGTON

← 1½ Spaces

MAINTENANCE STUDIES OF 35-FT-DEEP (MSL) NAVIGATION CHANNEL

← 2 Spaces

Hydraulic Model Investigation

← 4 Spaces

PART I: INTRODUCTION

← 3 Spaces

The Prototype

← 3 Spaces

1. Grays Harbor, Wash. (Figure 1), located about 45 miles* north of the mouth of the Columbia River and 93 miles south of Cape Flattery, is a large bay at the head of which is the Chehalis River. The roughly pear-shaped harbor diverges from the Chehalis River at Aberdeen, Wash., 15 miles east of the entrance, to a maximum width of 13 miles, including North and South Bays (Plate 1). The water-surface area of the harbor varies from about 94 square miles at mean higher high water (mhhw) to about 35 square miles at mean lower low water (mlw). The harbor is separated from the Pacific Ocean by two narrow sandy peninsulas. The northerly peninsula is 7 miles long and terminates at Point Brown, just north of the harbor entrance; Point Chehalis comprises the northern end of the southerly peninsula, which is 4 miles long. A more detailed description of the prototype is presented in Report 1** of this series.

← 3 Spaces

The Model

← 3 Spaces

2. The Grays Harbor model (Plate 1), constructed at the U. S. Army Engineer Waterways Experiment Station (WES) in 1968, reproduced approximately 230 square miles of the prototype area, including the

← 1½ Spaces

* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 4.

** N. J. Brogdon, Jr., "Grays Harbor Estuary, Washington; Verification and Base Tests; Hydraulic Model Investigation," Technical Report H-72-2, Report 1, Apr 1972, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Titles of Major Parts

15. The titles of each of the major parts of a report should be of the same style and form throughout the report, and no other headings should be similar to that style. These titles are used for the preface, contents, conversion factor table, major parts, references, and appendixes. They should be centered between the margins, typed in capitals, and not underlined. If the title requires more than one line, there should be no blank space between the lines. The arrangement for a two-line or three-line title is also the inverted pyramid. In typing the title of a major part of the text, the word "Part" and the part number in Roman numerals followed by a colon always precede the title. For example:

PART I: INTRODUCTION

Titles of major parts are not followed by a period. However, if the wording calls for an interrogation point or an exclamation point, this punctuation should not be omitted. Dividing words and separating closely related terms or groups of words should be avoided.

16. A major part of a report always begins a new page (Figure D4). Therefore, the first line of the part title should be on the first line of the page. It should be separated by three or four spaces from the material below it, whichever affords the best arrangement of the remainder of that part.

17. Frequently appendixes are composed entirely of tables, plates, or computer printouts. There is no page of text on which to type the title of the appendix. In these cases, the appendix title will be typed, centered, in capitals or capitals and lower-case letters (depending on the subdivision of the main text) on a fly sheet and inserted as the first page of the appendix. (The fly sheet is not numbered, but a page number is allowed for it.) If one appendix to a report requires a fly sheet, then each appendix therein will have a fly sheet.

HEADINGS

18. It will be recalled from the discussion in the main text that three forms of headings are used in WES reports: center, side, and paragraph. If further subdivisions are necessary, they take the form of subparagraphs and sub-subparagraphs.

Center Headings

19. Center headings are used for introducing the principal subdivisions of a major part of a report (see Figure D4). They should be centered between the margins, typed in lower-case letters with initial capitals, underlined, and should be single-spaced if more than one line long (Figure D4). The arrangement for a two-line, three-line, or longer title is inverted pyramid also. One-line headings should be separated by three spaces from the material above, and three spaces from the material below. Two-line headings should be separated by 2-1/2 spaces from the material above, and 2-1/2

PART II: LITERATURE REVIEW

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Composition of Secondarily Treated Wastewater

← 3 Spaces

6. The composition of secondary effluent can be quite variable depending on the characteristics of the primary waste materials and the modes of primary and secondary treatment. However, a typical secondary effluent (Table 1) has recently been presented by Reed.¹

← 2½ Spaces

Nitrogen Removal in Land Treatment of Secondarily Treated Wastewaters

← 2½ Spaces

7. In an evaluation of overland flow or any other type of land treatment, a division can be made between treatment processes that are primarily biological and those that are primarily chemical by distinguishing nitrogen treatment from the other elements of concern. This is not to imply that biological processes are not important in the treatment of components other than nitrogen, but to point out the significant role that microorganisms and plants play in the removal of nitrogen during land treatment of wastewater.

8. The major factor in nitrogen removal in most properly functioning land treatment systems is plant uptake.^{2,3} The conversion of nitrogen into plant protein is quite desirable since it is not only removed from wastewater, but is also made available directly or indirectly as a source of protein for animals and humans. Removal of 100 to 200 lb/acre* of nitrogen by agronomic crops is quite common. Fried and Broeshart⁴ report total removal of nitrogen of 155 and 133 lb/acre for corn and soybeans, respectively. Removal of 42 percent of the nitrogen applied in cannery wastewater by reed canary grass has been estimated for the Campbell Soup Company, Paris, Texas, overland flow treatment system.⁵ This removal of nitrogen in the form of plant protein is one of the inherent advantages of wastewater treatment on agricultural as opposed to forested lands.

* A table of factors for converting U. S. customary units of measurements to metric (SI) units is presented on page 4.

spaces from the material below (Figure D4). Center headings are not followed by a period, but if the wording calls for an interrogation or exclamation point, this should not be omitted.

Side Headings

20. Side headings are used to announce subordinate topics within major subdivisions. They should be underlined and typed in lower-case letters, except for the first word in the heading and the proper nouns, which are capitalized. Side headings are typed flush left and should be 1-1/2 spaces from the material above and below them (Figure D5). If the side heading is unusually long and requires two lines, these lines will be of approximately equal length extending to but *not* beyond the center of the page, and should be separated by two spaces from the material above and 1-1/2 spaces from the material below (Figure D6). The second line should begin flush left and should be the longer of the two if practicable.

Paragraph Headings

21. These headings are used to subdivide material appearing under a side heading. They are indented the same number of spaces as ordinary paragraphs, and they follow the paragraph number. The heading itself is underlined, including the period following it, but the paragraph number is not. The heading is typed in lower-case letters, except that the first word and proper nouns are capitalized. The body of the paragraph follows immediately after the heading and on the same line. (See Figure D7.)

CAPTIONS

22. Captions (titles) for illustrations (figures and photos) should be centered beneath the illustration, typed with the first letter of the first word and proper nouns initially capitalized. If caption requires two lines, type single space and center the second line also. If caption requires three or more lines, type single space and center the first line, align succeeding lines with the first line but center the last line. For example:

For unclassified reports

Figure 2. Verification of current velocities in the north
jetties with tide running out; range 1, station 2

Photo 1. Effects of plans 9 and 10 on surface
current patterns, ocean tide range, 5.0 ft,
depth, 9 ft 6 in.

For classified reports

Figure 1. (U) Major dimensions of aircraft studies (U)

For illustrations requiring more than one sheet:

**Figure 2. Two-layer flexible pavement expected value,
variance, and rutting models (Continued)**

Figure 2. (Concluded)

Figure 3. Construction of support foundations (Sheet 1 of 3)

Figure 3. (Sheet 2 of 3)

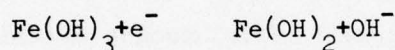
Figure 3. (Sheet 3 of 3)

Figure 1. (U) Major dimensions of aircraft studies (Sheet 1 of 2) (U)

Figure 1. (U) (Sheet 2 of 2)

but high in manganese, while CO_2 tension may be the regulating factor in soils low in both active iron and manganese.

25. The redox characteristics of a waterlogged soil are considered to be similar to a ferric-ferrous system.¹⁹ Under anaerobic conditions, the ferric ion undergoes reduction to the ferrous form, and the relative concentrations of both ions vary with the degree of reduction of the system. As the redox potential decreases, the amount of iron in solution increases because of the reduction of the ferric to ferrous form, the latter being more soluble in the soil solution. As a result of this process a corresponding increase in pH occurs. Patrick²⁷ explains that the simultaneous increase in pH and decrease in redox potential are due to the reduction of ferric hydroxide to ferrous hydroxide under reducing conditions; i.e.,



He states that a rapid decline in redox potential is characteristic of soils having a low content of reducible iron and manganese and a high organic matter content. Manganese and iron systems tend to buffer the soil at an intermediate redox potential of about +100 to +300 mv.

Availability of Various Elements Under Overland Flow Treatment Conditions

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Nitrogen

← 2½ Spaces

← 1½ Spaces

26. The availability of nitrogen under overland flow treatment conditions was discussed in paragraphs 7-18.

Phosphorus

← 1½ Spaces

27. Well-drained soils have been shown to differ in their capacity to fix phosphorus depending on the quantities of iron and aluminum oxides present,²⁸⁻³⁰ the kinds and amounts of clay minerals,³¹⁻³³ and the soil pH.²⁸

28. Iron and aluminum compounds are largely responsible for the fixation of phosphorus, especially under acid well-drained soil conditions.²⁸ Wild²⁹ found that: (a) a positive correlation exists between

Figure D5. Example of two-line center heading and one-line side headings

wetting period but in the nitrifying range during the weekend drying period. The redox potential at the 5-mm depth declined into the denitrifying range in only a few hours after wastewater application was initiated following the 2-day drying period. The redox potential at the 13-mm depth did not increase to +320 mv after the 2-day drying period. The accuracy of these redox curves is supported by similar results in two other experiments, one with soil from a cannery overland flow treatment site and the other with clay soil as used in this study but mixed with sewage sludge.⁷⁴

← 3 Spaces

Discussion

← 3 Spaces

130. An account of the wastewater constituents applied and removed during the study period measures the effectiveness of the overland flow method of disposal. This account was derived from results presented in the previous sections and is presented here in order to give an overall summary of the study period.

Nitrogen ← 1½ Spaces
← 1½ Spaces

131. Nitrogen from all sources was applied at the rate of 113 kg/ha of which 92 percent was retained in the model (Tables 11 and A23). Losses were only 9 percent organic nitrogen and 5 percent nitrate nitrogen in the runoff and essentially none in the subflow (Table 11). Ammonium nitrogen retention in the model was nearly 100 percent (Table 11). The grass harvests contained 35 kg/ha, 56.5 percent of the TKN. The unaccounted TKN and nitrate nitrogen, 69 kg/ha, may have been bound in the grass roots and stubble, located in the increased biological population of the soil, or lost as gaseous nitrogen following denitrification. The redox potential measurements indicate that denitrification could have been occurring continuously during the study period.

← 2 Spaces

Hypothesis of nitrogen
loss by denitrification ← 1½ Spaces

132. The model was operated for 4 days and allowed to dry for 3 days during most of the experiment, thus providing an additional

Figure D6. Example of two-line side heading

PART IV: RESULTS AND DISCUSSION

← 3 Spaces

Analyses of Waters

← 3 Spaces

Nitrogen compounds and phosphorus

← 1½ Spaces

77. Nitrate nitrogen. Since the secondary effluent only contained low concentrations of nitrate nitrogen, it was fortified with 6.7 mg/l of nitrate nitrogen from ammonium nitrate in order to obtain concentrations more commonly found in municipal wastewater. The fortified secondary effluent ranged from 6 to 20 mg/l in nitrate nitrogen concentrations. At the start of the experiment, nitrate concentration in the runoff was 6 mg/l, but it decreased in subsequent weeks to trace levels. Nitrate was detected in the subflow initially but was not found thereafter. Average weekly concentrations of nitrate nitrogen and other elements, etc., are given in Table 2. (Average weekly pH values are given in Table 3. Daily values of concentrations in applied effluent, runoff, and subflow, representing averages from two samples, are presented in Tables A1-A16. Similar values for pH are given in Table A17.)

78. The decrease in wastewater nitrate occurred primarily within the upper 10 ft of the model (Figure 3, Table A18). The average concentration decreased from 11 mg/l at the upper end of the model, to 1 mg/l at 10 ft, to 0.1 mg/l at 20 ft. For half of the samplings, no nitrate was detected from the lower 10 ft of the model.

79. Percentage mass removal values of various elements in the applied wastewater accounted for volume differences as well as concentration differences. Daily means of the effluent, runoff, and subflow volumes are presented in Table A19. The percentage of mass removal of nitrate nitrogen on a weekly basis showed 69, 97, and 100 percent removed from the applied effluent in the first, third, and sixth weeks, respectively (Table 4). Runoff essentially accounted for the balance of the nitrate. The subflow had a trace of nitrate for the first 2 weeks, and none thereafter.

80. Ammonium nitrogen. The secondary effluent also contained low

Figure D7. Example of paragraph headings

PART IV: TABLES

23. Table arrangement should be planned carefully to ensure a readable format. Each table is numbered and has a title (Figures D8 and D9). Each column has a heading or subheading and, if required, a unit of measure.

24. Tables in WES reports are generally printed on 8- by 10-1/2-in. paper. Occasionally, tables contain so much information they must be printed on larger size paper and folded.

25. Tables are generally arranged in the 6-in. by 9-in. format, the same as that for text. However, tables frequently require more area than this, and they are typed on paper large enough to accommodate the material they contain. The arrangement should be planned so that the width-to-length ratio is 2 to 3. These oversize tables are then reduced photographically to 6 by 9 in. Common table sizes and reductions are:

<u>Size, in.</u>	<u>Reduced to, percent</u>
9 by 13.4	67
8 by 12.0	75
7.5 by 11.2	80

26. If the table requires more than one page, the table *number* should appear on subsequent sheets, but not the title. For example:

Table 1 (Continued)

Table 1 (Concluded)—on last sheet

The word "(Continued)" is typed in the center at the bottom of each sheet except the last. Tables of more than two pages will be identified at the bottom right corner of each page. For example, for a table of three pages:

(Sheet 1 of 3)

(Sheet 2 of 3)

(Sheet 3 of 3)

27. A column heading should be centered over each column and underscored (Figure D8). The underscore should be as wide as the widest part of the column, whether it is the heading or an item in the column. The words in the column heading should be typed in initial capitals, except the unit of measurement (if there is one), which is typed in lower-case letters and separated from the rest of the heading by a comma (Figure D9). (The comma is not used if the unit of measure is on a line by itself.) Units of measurement are abbreviated (Figure D9).

28. Multiline headings should be single-spaced. *Each* heading builds up from its individual underscore (Figure D9).

29. Data having the same dimensions should be aligned by the decimal point or by the last digit, whichever is appropriate (Figures D8 and D9).

Table 17 $\leftarrow \frac{1}{2}$ Space
Effects of Dredged Material Disposal Island Plans 5, 6,
and 7 on Channel Shoaling in Hoquiam Reach $\leftarrow \frac{1}{2}$ Space
Note $\leftarrow \frac{1}{2}$ Space

Channel Section No.	Base		Shoaling Index*		
	Volume of Material Retrieved cc	Percent of Total Material Retrieved	Plan	Plan	Plan
			5	6	7
32	215	2.0	1.5	1.8	1.7
33	290	2.7	2.2	2.5	2.2
34	395	3.7	3.5	3.7	3.6
35	410	3.8	3.8	4.1	3.6
36	295	2.7	3.9	3.9	3.6
37	585	5.5	5.5	5.7	5.6
38	660	6.2	6.1	6.1	6.2
39	740	6.9	7.2	6.8	7.1
40	845	7.9	8.1	7.6	7.8
41	940	8.9	8.8	9.0	9.0
42	1,005	9.4	9.6	9.7	9.4
43	1,005	9.4	9.2	9.8	9.0
44	990	9.3	8.6	9.6	8.8
45	1,120	10.5	10.1	10.2	10.3
46	1,190	11.1	10.1	10.9	10.9
Total	10,685	100.0	98.2	101.4	98.8

$\frac{1}{2}$ Space (Continued)

* Shoaling index is the total amount of material recovered for a plan test divided by the total amount of material recovered for the base test.

(Sheet 1 of 3)

Figure D8. Example of table column heading and two subheadings

AD-A066 737

ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 5/2
GUIDE FOR PREPARATION OF WATERWAYS EXPERIMENT STATION TECHNICAL--ETC(U)
MAR 79 T B ROSSER, R T SMART, R M SCHAFF

UNCLASSIFIED

WES-INSTRUCTION-0-79-1

NL

2 OF 2
ADA
066737



END
DATE
FILMED

5-79
DDC

Table 2 ← 1½ Spaces
Basic Model Data of Conditions That Induced Failure of
Cellular Block Channel Expansions ← 1½ Spaces
← 1½ Spaces

Model* Culvert Size, ft	Dis- charge cfs	Tail- water Depth ft**	Depth of Flow at Culvert Outlet ft**	$\frac{Q}{D_o^{5/2}}$	F	$\frac{T_B}{D_o}$	$\frac{TW}{D_o}$	$\frac{T_B}{D_o} \times \frac{TW}{D_o}$
0.5 × 0.5	1.20	0.25	0.50	6.70	1.20	0.17	0.50	0.085
	2.00	0.50	0.50	11.30	2.00		0.87	0.150
	2.00	0.44	0.50	11.30	2.00		1.00	0.170
	2.40	0.90	0.50	13.60	2.39		1.80	0.310
1.0 × 1.0	1.00	0.10	0.25	1.00	1.40	0.08	0.10	0.008
	2.20	0.36	0.40	2.20	1.53		0.37	0.029
	2.40	0.61	0.57	2.40	0.98		0.61	0.049
	2.40	0.19	0.40	2.40	1.67		0.19	0.015
	3.10	0.61	0.60	3.10	1.17		0.61	0.049
	3.10	0.63	0.63	3.10	1.10		0.63	0.051
	3.30	0.60	0.60	3.30	1.25		0.60	0.048
	4.00	1.00	1.00	4.00	0.70		1.00	0.080
	4.50	1.30	0.99	4.50	0.80		1.30	0.104
	5.30	1.00	1.00	5.30	0.94		1.00	0.080
	5.80	1.50	1.00	5.80	1.02		1.50	0.120
	6.20	1.50	1.00	6.20	1.10		1.50	0.120
	4.95†	0.64	0.52	0.87	1.18	0.04	0.32	0.013
	5.25	0.30	0.46	0.92	1.50		0.15	0.006
	6.30	0.06	0.50	1.11	1.56		0.03	0.010
	7.40	0.70	0.81	1.30	0.90		0.35	0.014
	10.20	1.20	1.20	1.78	0.67		0.60	0.024
	14.20	1.72	1.80††	2.50	0.52		0.86	0.034

- ← 1½ Spaces
- * Model culvert sizes of 0.5, 1.0, and 2.0 ft correspond to prototype sizes of 2, 4, and 8 ft, respectively.
 ** Measured from invert of culvert.
 † Estimated value (instrumentation failure).
 †† Maximum depth.

Figure D9. Example of table column headings building up from underscore line

30. Tables having specific footnotes should have corresponding symbols identifying the footnoted item in the table (Figure D9). Footnote symbols should be arranged in proper sequence line by line, from left to right across the table. The symbols used in WES reports are:

*
**
†
††
‡
‡‡
§
§§

Footnotes are typed single space (Figures D8 and D9).

APPENDIX E: USE OF COPYRIGHTED MATERIAL

1. Copyrighted material will not be used in WES reports without the written consent of the copyright owner or the copyright owner's duly authorized agent.

2. A copyright is an exclusive right granted by Congress under authority of the Constitution to authors or proprietors for the protection of their literary and other intellectual productions. The copyright protects all the original works of an author provided they are properly marked with the requisite notice of copyright when published. Copyrights are granted for a term of 28 years with the right of renewal for an equal term.

3. Whenever copyrighted material is to be incorporated in a WES report, the WES author will obtain the prior written consent of the copyright owner or the copyright owner's duly authorized agent. When the WES author obtains the written consent he will forward it to P&GAD and it will be retained in the files of P&GAD.

4. A credit line will be used whenever it is requested by the copyright owner or his agent.

5. Generally, the copyright owner or his authorized agent will be willing to grant permission to the Department of the Army to publish for official purposes without charges. In obtaining such permission there is generally no need for the formalities of a legal document as required by more substantial rights.

6. In accordance with AR 310-1, the following checklist will be observed in making request for obtaining licenses without charge.

- a. The request will be for no greater rights than actually needed.
- b. The request will fully identify the material for which permission to publish is requested.
- c. The request for license will explain the proposed use and contain the conditions of license, so that the licensor need only give his consent.
- d. The request will be submitted to the copyright owner or his duly authorized agent in duplicate so that the owner or agent may retain one copy and return the other copy with his assent written thereon.
- e. A self-addressed return envelope will be inclosed.

7. Figure E1 is a sample format of request for release to use copyrighted material. Any such request will be patterned after the sample format.

8. Additional information regarding the use of copyrighted material is given in AR 310-1, Chapter 1, Section IV.

LETTERHEAD

(Name of Company)
(Address)
(Salutation)

RELEASE

This office is engaged in the preparation of the manuscript material for a work to be published under the title _____

(Insert title when known)

Permission is requested to include in the above-identified work the following material, to wit: (Here insert specific information with respect to the pages and lines of the illustrations and/or textual matter to be released.) of the work entitled _____, published by your company and written by _____.

It will be appreciated if you will indicate below, on one copy of this letter, whether the above-identified material may be used in the above work, and whether an appropriate credit line is desired. A self-addressed envelope is inclosed for your convenience.

(Signature)

(Title)

(Address)

Publisher's permission:

The above RELEASE is hereby granted, royalty free.

The material covered by this release (may) (may not)* be placed on sale by the U. S. Government Printing Office.

Credit line (is) (is not)* requested.

*Line out response not applicable.

(Name of copyright owner or
authorized agent)

By _____

(Title)

Date: _____

Figure E1. Sample format of request for permission to use copyrighted material

APPENDIX F: MULTICOLOR PRINTING

1. Printing in two or more colors increases the cost of a publication and as such is generally prohibited by AR 310-1, paragraph 1-15, except when such color meets the valuable contribution criteria described therein. Therefore, multicolor printing in WES reports will be approved only when it will make a valuable contribution toward fulfilling the intended purpose of the report.

2. "Valuable contribution" includes:

- a. Maps and technical diagrams where additional color is needed for clarity.
- b. Object identification.
- c. Areas where definite savings in costs can be predicted based on multicolor use.

3. Justification for the use of additional colors in a WES report and the approval thereof will be signed by the Division or Laboratory Chief and will be forwarded to P&GAD where it will be retained as a part of the printing request file.

4. An example of a justification form is shown in Figure F1.

U. S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION CORPS OF ENGINEERS OFFICE OF THE DIRECTOR Vicksburg, Mississippi	
Title of Publication: _____	

Publication No.: _____	Publication Date: _____
Author(s) of Publication: _____	
Job No.: _____	
I certify that the multicolor printing required in the publication described above meets the requirements of paragraph 1-15 of AR 310-1.	
_____ Name and Title	

Figure F1. Example of a justification for multicolor printing

APPENDIX G: INDEX

- Abbreviations, 24, 34-35, B1-B5
 - agency names, 35
 - units of measure, B1-B5
- Abstract, 14-17, 53
- Acknowledgments, 17
- Active voice, 54
- Alphabet, Greek, 35, C1
- Analysis (or interpretation) of results, 21
- Appendix
 - format for, 33-34
 - illustration numbering, 33-34
 - page numbering of, 33
 - references in, 34
 - table numbering, 33-34
 - uses of, 23
- Approach
 - chronological, 19-20
 - topical, 19-20
- Author
 - check of editing by, 43
 - preliminary planning by, 37
- Author/editor
 - checklist, 51-53
 - relation, 50-51
- Authorities for spelling, 34
- Authorization, 17
- Bibliography/References, 21-22, 32-33, 60-61
- Body of report or main text, 19-21
- Capitalization, 34
- Catalog card, facsimile of, 26
- Categories of WES reports, 7
- Center headings
 - example of two-line, D11
 - use of, 27-28, D7, D9
- Characteristics of paragraphs, 49-50
- Checklist for author/editor, 51-53
- Check of editing by author, 43
- Chemical symbols, 35
- Choice of words, 48
- Chronological approach, 19-20
- Citing of classified references, 22
- Classified references, citing of, 22
- Clauses
 - nonrestrictive, 56-57
 - restrictive, 56-57
- Cliches, 48
- Coherence of paragraph, 49-50
- Coined words, 48
- Collective nouns, 55
- Colors of WES report covers, 8
- Components of WES reports, 8
- Compound words, 34
- Comprehensive and series titles, D5, D6
- Computer program documentation notice, 13-14
- Conclusions, 17, 21
- Consistency, nomenclature, 54-55
- Contents, table of, 14, 17, 53
- Continuation of tables
 - of more than one sheet, D14
 - of more than two sheets, D14
- Contractor-prepared reports, 44-45
- Controlling DoD office, 9, 43, 46
- Conversion factors, U. S. customary to metric (SI)
 - units of measurement, 14, 17, 18, D6, D8
- Copyrighted material
 - credit line and request to use, E1,
 - format of request to use, E2
 - permission to use, 17
- Covers
 - color of, 8
 - for classified report, example of, 11
 - for contractor-prepared report, example of, 12
 - for unclassified report, example of, 10
- Credit line and request to use
 - copyrighted material, E1
- Dangling modifiers, 56
- DD Form 1473 (Report Documentation Page), 8, 14, 15-16, 27
- Decimals, use of, 36
- Defense Documentation Center (DDC), 6, 24, 46
- Description of study, writing the, 20-21
- Dimensions of typed area of page, D2, D8
- Disclaimer, 9
- Disposition instructions, Form 1064, 9, 37, 41-42, 43
- Dissertations and theses, 46
- Distribution
 - exchange agreements, 24
 - limited, 5, 24, 26, 44, 46
 - lists, 24, 26, 44, 46
 - of reports, 46
 - statement, 9, 13, 42-45
 - unlimited, 24, 46
- DNA format, 8
- "Do" and "Don't" suggestions for sentences, 48-49
- Documentation notice, computer program, 13-14
- Draft
 - final, 43-44
 - preliminary working, 37, 43-44
- Drafting support, 28, 32
- Drawings, letter sizes for, 28, 32
- Duty of writer, 47-48
- Economy of
 - photos, 52
 - plates, 52
- Editing, types 1-4, 41, 51
- Editor
 - editorial marks, 53
 - functions of, 51
- Editorial marks
 - editor, 53
 - proofreader, 53
- Emphasis of paragraph, 49-50
- Equations, mathematical expressions and, C1-C9
- Example(s) of
 - a table, 29, D15, D16
 - a good photo, 30

Example(s) of (continued)

cover for
 classified report, 11
 contractor-prepared report, 12
 unclassified report, 10
DD Form 1473 (Report Documentation Page), 15-16
flowchart, WES report, 37, 38
footnotes, 8, 22, 28, 29, 47, A2, B1, B2, B3, B4, B5, C2,
 D6, D8, D15, D16
indentions, D4
index, G1
key, 19
list of tables and illustrations, 18
notation, 25
one-line side heading, D11
paragraph headings, D13
references and bibliography, 1, 60-61
subparagraphs, D4
two-line center heading, D11
two-line side heading, D-12
Executive Office review, 44
Expressions and equations, mathematical, C1-C9

Facsimile of catalog card, 26

Faults, word, 48

Figures, 28, 33-34, 52, 58

Figures and photos, setup of titles of
 for classified reports, D9-D10
 for unclassified reports, D9-D10
 of more than one sheet, D10
 of one sheet, D9
 with titles requiring more than two lines, D9
 with titles requiring two lines, D9

Figures and tables, example of list of, 18

Final

 draft, 43-44

 reproduction, 44

Flowchart, WES report, 37, 38

Footnote(s)

 examples of, 8, 22, 28, 29, 47, A2, B1, B2, B3, B4, B5,
 C2, D6, D8, D15, D16

 symbols, sequence of, D17

Format

 DNA, 8

 for appendixes, 33-34

 mechanics of, D1

 of request to use copyrighted material, E2

Form

 1064, WES, disposition instructions, 9, 37, 41-42, 43

 1428, WES, report timetable, 37, 39

 1473, DD (Report Documentation Page), 8, 14, 15-16, 27

Function of

 editors, 51

 proofreaders, 53

Fuzzy words, 48

Graphs, 58-59

Greek alphabet, 35, C1

Guides for punctuation, 34

Heading(s)

 center, 27-28, D7, D9

 example of, D13

 mechanics of, D1

Heading(s) (continued)

 paragraph, 27-28, D9

 side, 27-28, D9

 system, primary breakdown, 27-28

Hyphenation, 34

Illustrations and tables, preparation of, 22, 28, 33-34, 52

Illustrations, list of tables and, 14, 17, 18

Indentions, D2, D4

Index, 24, G1

Information

 placed in Preface, 14, 17, 22, 51-52

 Service, National Technical, 24

Instruction(s)

 reports, 7, 8, 44

 to P&GAD, 41-42

In-text tabulations, 28

Introduction, 20, 52

Isotopes, symbols for, 35

Jargon words, 48

Journals, papers prepared for, 46

Justification for use of multicolor printing, F1

Juxtaposition, C2

Key

 color of paper, 19

 example of, 19

 location in report, 19

 order in report, 14

 proprietary products and/or equipment, 17

 recipients of, 19

Key words, 14

Letter sizes for drawings, 28, 32

Limited distribution, 5, 24, 26, 44, 46

List(s)

 distribution, 24, 26, 44, 46

 of tables and illustrations, 14, 17, 18

Main

 narrative, 52

 report title, 53, D5

 text and preliminaries, page numbering of, 27

 text material, outline of, 19-20

 text or body of report, 19-21

Major parts, titles of, D7

Margins for text page, D2

Mathematical

 expressions and equations, C1-C9

 symbols, 35, C1-C2

Mechanics of

 format, D1

 headings, D1

 tables, D1

 titles, D1

Metric (SI) units of measurement, conversion factors,

 U. S. customary to, 14, 17, 18, D6, D8

Miscellaneous Papers, 7, 8, 44, 45-46

Modifiers, dangling, 56

Multicolor printing, justification for use of, F1

Narrative, main, 52

National Technical Information Service, 24

Nomenclature consistency, 54-55
 Nonrestrictive
 clauses, 56-57
 phrases, 56-57
 Notation(s)
 definition of, 23-24
 example of, 25
 involving powers of ten, 57-58
 Nouns, collective, 55
 Numbering
 of tables, 28
 pages, 27, 33
 system for reports, 7-8
 Numerals, use of, 34-35

 One-line side heading, spacing for, D11
 Order of
 preliminary pages, 14
 reference to tables in illustrations, 58-59
 Outline of main text material, 19-20
 Overformal words, 48

 Page numbering
 of appendixes, 33
 of preliminaries and main text, 27
 P&GAD, instructions to, 41-42
 Paper(s)
 Miscellaneous, 7, 8, 44, 45-46
 prepared for journals, 46
 prepared for professional societies, 46
 presented at symposiums, 46
 size of, D2
 Paragraph(s)
 characteristics of, 49-50
 coherence of, 49-50
 emphasis of, 49-50
 headings, 27-28, D9
 headings, example of, D13
 numbering of, preliminary pages and main text, 27
 unity of, 49-50
 Part, beginning a new page, spacing for, D8
 Passive voice, 54
 Past tense, use of, 56
 Person, third, 55-56
 Photo(s)
 economy of, 52
 example of a good, 30
 placement of, 28
 Phrases
 nonrestrictive, 56-57
 restrictive, 56-57
 Placement of
 photos, 28
 plates, 28
 Plates
 economy of, 52
 placement of, 28
 Powers of ten, notations involving, 57-58
 Preface, information placed in, 14, 17, 22, 51-52
 Preliminary page(s)
 and main text, page numbering of, 27
 and main text, paragraph numbering of, 27
 order of, 14
 Preliminary planning by author, 37

 Preliminary working draft, 37, 43-44
 Preparation of tables and illustrations, 22, 28, 33-34, 52
 Present or future tense, use of, 56
 Primary breakdown of heading system, 27-28
 Printing, multicolor, justification for use of, F1
 Procedure, report-while-testing, 20
 Professional societies, papers prepared for, 46
 Pronouns, relative, 55
 Proofreader(s)
 editorial marks, 53
 function of, 53
 Proprietary products and/or equipment, 17
 Punctuation, guides for, 34

 Recommendations, 17, 21
 References/Bibliography, 1, 21-22, 32-33, 60-61
 References
 citing in appendix, 34
 citing of classified, 22
 unsuitable, 22
 Relation of author/editor, 50-51
 Relative pronouns, 55
 Report Documentation Page (DD Form 1473), 8, 14, 15-16, 27
 Report(s)
 contractor-prepared, 44-45
 covers, 8
 designation, 7
 distribution of, 46
 Instruction, 7, 8, 44
 numbering system for, 7-8
 outline for, 19-20
 principal requirements of, 6
 research, 8
 Technical, 7, 8
 title, main, 53, D5
 Report-while-testing procedure, 20
 Reproduction (final), 44
 Request to use copyrighted material, E2
 Research reports, 8
 Restriction statement (trade names notice), 9
 Restrictive
 clauses, 56-57
 phrases, 56-57
 Results, analysis (or interpretation) of, 21
 Review, Executive Office, 44

 Sentence(s)
 "do" and "don't" suggestions for, 48-49
 topic, 47, 49
 Sequence of footnote symbols, D17
 Series title and title, spacing for, D6
 Setup of titles of figures and photos
 for classified reports, D9-D10
 for unclassified reports, D9-D10
 of more than one sheet, D10
 of one sheet, D9
 with titles requiring more than two lines, D9
 with titles requiring two lines, D9
 Side heading(s)
 example of one-line, D11
 example of two-line, D12
 use of, 27-28, D9

Single-spaced subparagraphs, spacing for, D4

Size of

paper, D2

text page, D3

Spacing for

one-line side heading, D11

part beginning a new page, D8

series title and title, D6

single-spaced subparagraphs, D4

two-line center heading, D11

two-line side heading, D12

Spelling

authorities for, 34

preferred spelling, A1-A4

Sponsoring office, 43-44

Strong verbs, 54

Study, writing the description of, 20-21

Subparagraphs

examples of, D4

use of, 27, 33

Sub-subparagraphs, 27

Summary, 14, 17, 52-53

Support, drafting, 28, 32

Symbols

chemical, 35

for isotopes, 35

mathematical, 35, C1-C2

Symposiums, papers presented at, 46

Table(s)

and illustrations, example of list of, 18

and illustrations, preparation of, 22, 28, 33-34, 52

continuation of

list of, 14

of more than one sheet, D14

of more than two sheets, D14

example of, 29, D15, D16

mechanics of, D1

numbering of, 27, 28

of contents, 14, 17, 53

order of reference to, 28, 58-59

Tabulations, in-text, 28

Technical

Information Service, National, 24

Reports, 7, 8

Text (or body of report)

main, 19-21

page, margins for, D2

page, size of, D3

units of measure in, 34-35

Theses and dissertations, 46

Third person, 55-56

Timetable for WES reports, 37, 39

Title(s)

comprehensive and series, D5-D6

main report, 53, D5

mechanics of, D1

of figures and photos, setup of

for classified reports, D9-D10

for unclassified reports, D9-D10

Title(s) (continued)

of more than one sheet, D10

of one sheet, D9

with titles requiring more than two lines, D9

with titles requiring two lines, D9

of major parts, D7

Topical approach, 19-20

Topic sentence, 47, 49

Trade names, 17

Trade names notice (restriction statement), 9

Translations, 7, 8

Two-line center heading, spacing for, D11

Two-line side heading, spacing for, D12

Typed area of page, dimensions of, D2, D3

Types 1-4 editing, 41, 51

Units of measure in text, 34-35

Unity of paragraphs, 49-50

Unlimited distribution, 24, 46

U. S. customary to metric (SI) units of measurement

conversion factors, 14, 17, 18, D6, D8

Use of

appendixes, 23

decimals, 36

numerals, 34-35

past tense, 56

present or future tense, 56

visual aids, 47

Verbs

strong, 54

weak, 54

Visual aids, use of, 47

Voice

active, 54

passive, 54

Weak verbs, 54

WES Form(s)

1064, disposition instructions, 9, 37, 41-42, 43

1428, report timetable, 37, 39

WES report(s)

categories of, 7

components of, 8

covers, colors of, 8

flowchart, 37, 38

timetable for, 37, 39

word list for, A1-A4

Word(s)

choice of, 48

coined, 48

compound, 34

faults, 48

fuzzy, 48

jargon, 48

key, 14

list for WES reports, A1-A4

overformal, 48

Writer, duty of, 47-48

Writing, the description of study, 20-21

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